agenda

Title of Meeting	111th Meeting of the Public Health Agency Board
Date	18 April 2019 at 1.30pm
Venue	Fifth Floor Meeting Room, 12/22 Linenhall Street, Belfast

standing items

1 1.30	Welcome and apologies		Chair
2 1.30	Declaration of Interests		Chair
3 1.30	Minutes of Previous Meeting held on 21 March 2019		Chair
4 1.30	Matters Arising		Chair
5 1.35	Chair's Business		Chair
6 1.40	Chief Executive's Business		Chief Executive
7 1.50	Finance Report	**PHA/01/04/19**	Mr Cummings

committee updates

8 2.00	Update from Governance and Audit Committee	**PHA/02/04/19**	Mr Drew

items for approval

9 2.10	PHA Assurance Framework 2019/20	**PHA/03/04/19**	Mr McClean
10 2.20	Newborn Hearing Screening Programme Annual Report 2016-17	**PHA/04/04/19**	Dr Mairs

items for noting

11 2.35	Annual Vaccine Preventable Diseases Report for Northern Ireland 2019	**PHA/05/04/19**	Dr Mairs

12 2.50	Point Prevalence Survey of Healthcare Associated Infection and Antimicrobial Use in Northern Ireland Acute Hospitals	**PHA/06/04/19**	Dr Mairs

closing items

13 Any other Business
3.05

14 Details of next meeting:

Tuesday 11 June 2019 at 2:15pm (Special Board Meeting)

Conference Rooms, 12/22 Linenhall Street, Belfast

minutes

Title of Meeting	110th Meeting of the Public Health Agency Board
Date	21 March 2019 at 1.30pm
Venue	Board Room, Gransha Park House, 15 Gransha Park, Clooney Road, Derry / Londonderry

Present

Mr Andrew Dougal	-	Chair
Mrs Valerie Watts	-	Interim Chief Executive
Mr Edmond McClean	-	Interim Deputy Chief Executive / Director of Operations
Mrs Mary Hinds	-	Director of Nursing and Allied Health Professionals
Dr Adrian Mairs	-	Acting Director of Public Health
Councillor William Ashe	-	Non-Executive Director
Mr John-Patrick Clayton	-	Non-Executive Director
Mr Leslie Drew	-	Non-Executive Director
Ms Deepa Mann-Kler	-	Non-Executive Director
Professor Nichola Rooney	-	Non-Executive Director
Mr Joseph Stewart	-	Non-Executive Director

In Attendance

Mr Paul Cummings	-	Director of Finance, HSCB
Ms Marie Roulston	-	Director of Social Care and Children, HSCB
Ms Nicola Woods	-	Boardroom Apprentice
Mr Robert Graham	-	Secretariat

Apologies

Alderman Paul Porter	-	Non-Executive Director
Mrs Joanne McKissick	-	External Relations Manager, PCC

16/19	**Item 1 – Welcome and Apologies**
16/19.1	The Chair welcomed everyone to the meeting. Apologies were noted from Alderman Paul Porter and Mrs Joanne McKissick.
17/19	**Item 2 - Declaration of Interests**
17/19.1	The Chair asked if anyone had interests to declare relevant to any items on the agenda. No interests were declared.

18/19	**Item 3 – Minutes of previous meeting held on 21 February 2019**
18/19.1	The minutes of the previous meeting, held on 21 February 2019, were approved as an accurate record of that meeting subject to amendments.
18/19.2	In paragraph 10/19.9, Mr Clayton wished it to be recorded in the minutes that he had an interest in that matter as he knew the individual leading on that research. Mr Clayton also asked that his comment noting a retraction of £1.7m in Transformation monies be included as part of paragraph 7/19.4
18/19.3	Two minor amendments were also made, the word "it" was removed from the second line of paragraph 10/19.8, and the words "is also developing" were replaced by "has developed" in paragraph 5/19.2.
19/19	**Item 4 – Matters Arising**
19/19.1	The Chair asked if a report on the pilot referred to in paragraph 10/19.7 could be made available once completed. Dr Mairs said that this would be possible.
20/19	**Item 5 – Chair's Business**
20/19.1	The Chair advised that he had shared with Dr Mairs an article relating to life expectancy, and how the rate of increase has decreased by 75%. He queried whether this was the situation in Northern Ireland. Dr Mairs said that he had spoken to Adele Graham in the PHA Operations directorate and that the situation here is similar to other parts of the United Kingdom.
20/19.2	The Chair informed members that in advance of this meeting, he had participated in a teleconference with representatives of the other UK countries which covered a range of subjects including EU Exit.
20/19.3	The Chair said that he will be chairing a meeting of the Disability Champions network where he hoped to raise the issue of employment agencies encouraging people with disabilities to apply for posts.
21/19	**Item 6 – Chief Executive's Business**
21/19.1	The Interim Chief Executive informed members that PHA hosted a one day symposium around healthcare-associated infection, antimicrobial resistance and antimicrobial stewardship. She said that the event featured presentations from world renowned speakers, updates from the surveillance teams and the sharing of best practice and learning from work undertaken to date. She added that the expert-led sessions in this symposium highlighted and debated the key challenges for HCAI and antimicrobial resistance, whilst also provided evidence based practical solutions to address these challenges.

21/19.2 The Interim Chief Executive advised that the HCAI/AMR event was attended by approx. 140 delegates from across Northern Ireland with representation from all five trusts, PHA, HSCB, RQIA, DoH, Queens University, Ulster University, Department of Agriculture, Department of Finance etc. and that key speakers were invited from World Health Organisation, Public Health England, Health Protection Scotland and HSC Republic of Ireland.

21/19.3 The Interim Chief Executive told members that the first national Family Nurse Partnership programme learning event was held on the 12th March at Riddel Hall, Stranmillis and that Dr David Olds, founder of the FNP programme and Anne Rowe, International Consultant spoke at the event. She said that the programme reflected on the evidence and research, listening to other international FNP communities' work and learning from clients stories. She added that over eighty people attended the event and the highlight of the day was three young parents telling of their lived experience of the programme.

21/19.4 The Interim Chief Executive advised that on 6th March, PHA hosted a 'Five Country Care Home Workforce Seminar' which was attended audience including care home nurses and provider, Trusts staff and staff from HSCB and PHA. She said that the keynote speaker was Karen Spilsbury from the University of Leeds and also in attendance at the event were officers from the Departments of Health in Scotland, Wales and Republic of Ireland who outlined their relative policy positions in respect of care home staffing. She advised that there was positive feedback and it is hoped to arrange another meeting in 6 months' time, possibly in Dublin.

21/19.5 The Interim Chief Executive informed members that during March, PHA was involved in several high-profile media initiatives on issues related to drug misuse. She said that at the launch of NISRA's data on drugs-related deaths, PHA's Michael Owen attended the press briefing and carried out interviews with BBC, UTV, Q Radio, Downtown/Cool FM, and the Press Association, covering issues from the dangers of polydrug misuse, the Take Home Naloxone programme, and highlighting support services available through the PHA website. She said that Mr Owen also took part in UTV's 'Up Close' panel discussion show on drugs. Covering areas of overall drug use, dangers of misusing drugs, Take Home Naloxone programme and highlighting support services, and that he also participated in a live broadcast interview from Extern on BBC Good Morning Ulster.

21/19.6 Mr Clayton asked if it would be possible to receive copies of the presentations made at the "Five Country Care Home Workforce Seminar". Mrs Hinds undertook to check if this would be possible.

21/19.7 The Chair asked if all of the organisations involved in addiction work together. Dr Mairs said that within Health Improvement, there are structures which ensure that all of the key players are working together.

He commended Mr Owen for his work in dealing with this difficult and controversial area of work. He added that those staff involved in drugs and alcohol would receive many queries from MLAs regarding the work being undertaken by the PHA.

22/19 **Item 7 – Finance Report (PHA/01/03/19)**

22/19.1 Mr Cummings advised that there had been little change since the previous Finance Report, but that over the last few weeks there has been significant work undertaken to ensure that PHA finishes the year in a break even position. He advised that the two main issues, which related to vaccines and the Lifeline contract, had been resolved. It has also been possible to secure some additional in-year funding from the Department of Health which has been used to address some small cost pressure areas, and to bring forward payment on research and development.

22/19.2 Mr Cummings reported an underspend in the management and administration budget, but he noted that the amount is similar to what will be required of PHA in terms of savings in 2019/20.

22/19.3 Mr Drew asked if the running costs of Lifeline remained steady or had increased. Mr McClean said that the programme was well within its budget, but there were some additional costs with the transfer of staff to Agenda for Change terms and conditions. Professor Rooney asked if the transfer of the Lifeline service to the Belfast Trust is temporary. Mr McClean confirmed it was and the focus now is to stabilise this service and integrate it with other mainstream HSC Mental Health Services. Councillor Ashe asked if project funding is being utilised for staffing costs. Mr McClean said that historically, even with the full and proper running of the Lifeline service, not all of the available budget was required and this was used to fund other preventative suicide and self-harm services.

22/19.4 Mr Clayton said that at the last Board meeting he had raised a concern about the retraction of Transformation funding, and he confirmed that he had written to Sharon Gallagher regarding this.

22/19.5 The Board noted the Finance Report.

23/19 **Item 8 – Update from Governance and Audit Committee (PHA/02/03/19)**

23/19.1 Mr Drew advised that at the most recent meeting of the Governance and Audit Committee, three of the papers which are due to be considered in this meeting were approved and he commended them to the Board.

23/19.2 Mr Drew gave an overview of other papers considered at the meeting beginning with the Corporate Risk Register. He advised that two risks had been removed from the Register, but that both may be reinstated

during 2019/20. He went on to say that the Committee was given an update on the process relating to obtaining assurances now that Controls Assurance Standards have been phased out.

23/19.3 Mr Drew advised that Internal Audit had not presented any new reports, but would shortly be carrying out an audit of Payroll Shared Services. He said that the recently appointed external auditors, ASM, had presented their strategy.

23/19.4 Mr Drew said that the Committee had received an update on the Information Governance Action Plan and that there is an ongoing issue in relation to the take up of staff training. He acknowledged that staff were very busy.

23/19.5 The Board noted the update from the Committee Chair.

24/19 Item 9 – PHA Business Plan 2019/20 (PHA/03/03/19)

24/19.1 The Chair welcomed Miss Taylor to the meeting to present item 9, 11 and 12.

24/19.2 Miss Taylor reminded members that PHA is required to produce an annual Business Plan based on its current Corporate Plan. She said that following the recent workshop a copy of the draft Plan was circulated to Board members and to the Department of Health. She highlighted the key changes, namely three new actions at the end of sections 3, 4 and 5.

24/19.3 The Chair asked about the origin of the objective leading to homelessness. Dr Mairs said that this has come from the Department of Health. Mr McClean explained that there are various strands of work relating to homelessness being carried out across PHA and HSCB and that Mrs Hinds recently convened a meeting of all parties to ensure this work was integrated fully. Ms Mann-Kler asked if there were up to date figures available regarding homelessness. Mrs Hinds said that she did not think that data were available and she commented on the high instances of “sofa surfing”. Mr Clayton said that he was pleased to see that homelessness was in the Plan, but he felt there needed to be a discussion, perhaps at a Board workshop, around poverty.

24/19.4 Professor Rooney asked about the impact of last year’s Business Plan and how PHA can determine what difference it has made. Miss Taylor said that PHA is trying to introduce a more outcomes-based approach, but that some objectives are more easily measured than others. She said that a report on last year’s objectives will come to the Board in June. Professor Rooney suggested that the objectives may be too wide, hence it is more difficult to measure success. The Chair added that during the period of the Corporate Plan, the organisation should take stock to consider how quickly, or not, it is achieving the objectives in its Plan. He also added that the Board should keep a keen focus on

	outcomes.
24/19.5	Members **APPROVED** the draft PHA Annual Business Plan for 2019/20.
25/19	**Item 10 – Review of PHA Standing Orders and Standing Financial Instructions (PHA/04/03/19)**
25/19.1	Mr McClean presented the review of Standing Orders and advised that the substance of the document was largely unchanged.
25/19.2	Mr Cummings advised that the Standing Financial Instructions had also undergone minor alteration.
25/19.3	The Board **APPROVED** the revised Standing Orders and Standing Financial Instructions.
26/19	**Item 11 – PHA Business Continuity Plan (PHA/05/03/19)**
26/19.1	Miss Taylor said that the Business Continuity Plan is an essential part of PHA's core governance. She said that the Plan is reviewed regularly and an annual desktop exercise undertaken with senior managers.
26/19.2	In terms of amendments to the Plan, Miss Taylor said that these were mostly minor, and she assured members that the Plan will continue to be kept under review in the context of EU Exit and cyber security.
26/19.3	The Board **APPROVED** the PHA Business Continuity Plan.
27/19	**Item 12 – Data Protection Impact Assessment Policy and Guidance (PHA/06/03/19)**
27/19.1	Miss Taylor explained that under GDPR, organisations need to have a Data Protection Impact Assessment Policy (DPIAP). She said that it is a complex area, but that PHA has developed a suite of documents to guide staff through the process. She added that both she and Karen Braithwaite can also assist staff if required. She finished by saying that the Policy and Guidance have been approved by both the Information Governance Steering Group and the Governance and Audit Committee.
27/19.2	Mr Drew said that the guidance is a very useful way of helping staff, but he said that it is important that there is training provided and to ensure that the policy is adhered to. Mr McClean agreed that the challenge for organisations is to ensure that this is not merely seen as a bureaucratic exercise.
27/19.3	Mr Stewart complimented the work done in developing this final version of the policy.
27/19.4	Ms Mann-Kler noted that staff are now potentially required to consider a range of impacts when developing plans – equality, rural screening and

	now Data Protection Impact and asked if there was any information that could be taken from one to another, or if there could potentially be a clash in terms of the impacts. She also asked if training would be available. Miss Taylor said that there is no particular training on DPIA, but that Information Asset Owners and Information Asset Assistants sit on the Information Governance Steering Group and can assist. She added that a database is starting to be built up of DPIAs so staff can access this.
27/19.5	Mr Clayton said that he was heartened that the process is not seen as bureaucratic and he felt that having the database will help staff. He said that there was a challenge, particularly with regard to equality impact assessments. Mr McClean said that his only major concern is being able to access relevant information on what inequalities there may be. Dr Mairs made the same point, but he also felt that while these impact assessments are relevant, they place a burden on staff. Ms Mann-Kler asked if there was a central repository of information held by the Equality Commission, but Mr McClean said that although this question has been fed back, it is still up to organisations like the PHA to find out the information it needs for its screenings.
27/19.6	The Board **APPROVED** the Data Protection Impact Assessment Policy and Guidance.
28/19	**Item 13 – Any Other Business**
28/19.1	There was no other business.
29/19	**Item 14 – Details of Next Meeting**
	Thursday 18 April 2019 at 1:30pm
	Fifth Floor Meeting Room, 12/22 Linenhall Street, Belfast
	Signed by Chair:
	Date:

Public Health Agency

Finance Report

2018-19

Month 11 - February 2019

PHA Financial Report - Executive Summary

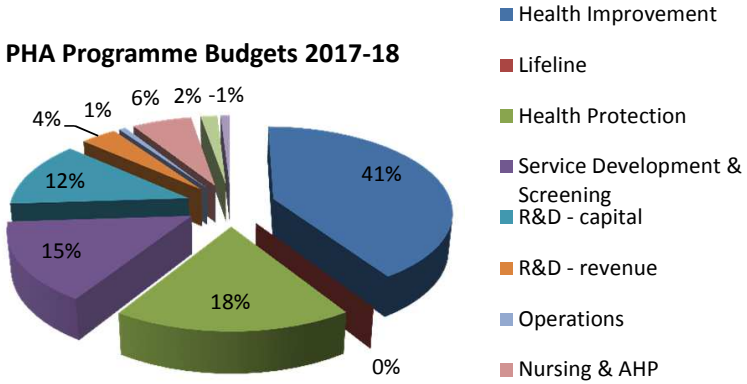
Year to Date Financial Position (page 2)

At the end of month 11 PHA is underspent against its profiled budget by approximately £0.9m. This underspend is primarily within PHA Direct Programme budgets (page 4), and also includes some underspends on Administration budgets, as shown in more detail on page 5.

Whilst this position is not unusual for this stage of the year due to the difficulty of accurately profiling expenditure, budget managers are being encouraged to closely review their positions to ensure the PHA meets its breakeven obligations at year-end.

Programme Budgets (pages 3&4)

The chart below illustrates how the Programme budget is broken down across the main areas of expenditure.

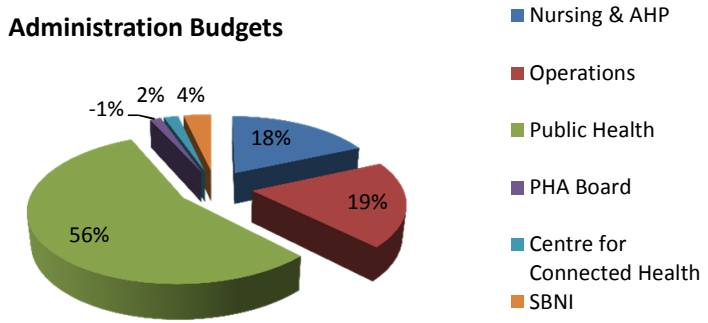


Administration Budgets (page 5)

Approximately half of the Administration budget relates to the Directorate of Public Health, as shown in the chart below.

A significant number of vacant posts remain within PHA, and this is creating slippage on the Administration budget.

Management is proactively working to fill vacant posts and to ensure business needs continue to be met.



Full Year Forecast Position & Risks (page 2)

PHA is currently forecasting a breakeven position for the full year. Slippage is expected to arise from Administration budgets in particular, however management expect this to be used to fund a range of in-year pressures and initiatives. A retraction of £0.6m unspent ringfenced funds, including Confidence and Supply Transformation Funds, has been assumed at month 11.

Public Health Agency
2018-19 Summary Position - February 2019

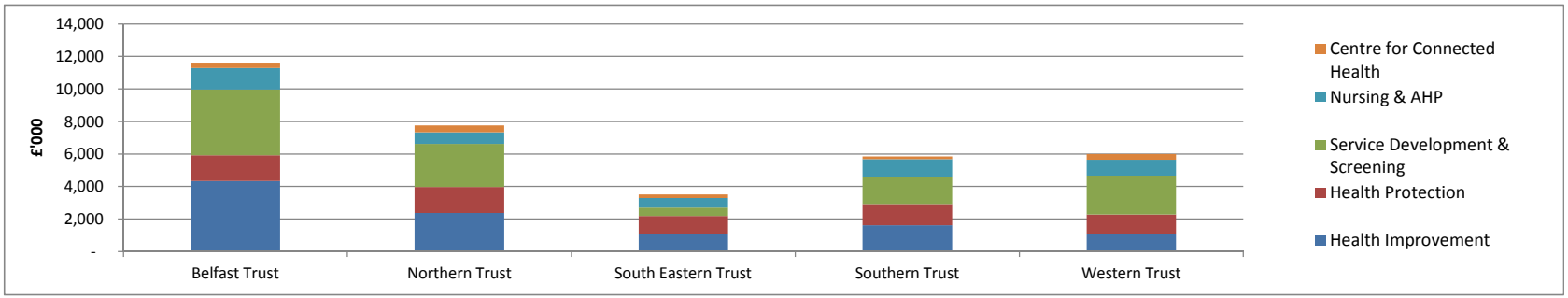
	Annual Budget					Year to Date				
	Programme		Ringfenced	Mgt &	Total	Programme		Ringfenced	Mgt &	Total
	Trust	PHA Direct	Trust & Direct	Admin		Trust	PHA Direct	Trust & Direct	Admin	
	£'000	£'000	£'000	£'000	£'000	£'000	£'000	£'000	£'000	£'000
Available Resources										
Departmental Revenue Allocation	34,746	41,002	7,135	19,326	**102,213**	31,629	37,291	5,674	17,397	**91,989**
Revenue Income from Other Sources	28	371		690	**1,089**	26	371	-	641	**1,038**
Departmental Allocation Retraction	-	-	(560)	-	**(560)**					
Total Available Resources	34,775	41,373	6,575	20,016	**102,739**	31,655	37,662	5,674	18,038	**93,028**
Expenditure										
Trusts	34,775	-	3,680	-	**38,455**	31,876	-	3,374	-	**35,250**
PHA Direct Programme *	-	42,023	2,895	-	**44,918**	-	36,982	2,222	-	**39,204**
PHA Administration	-	-	-	19,366	**19,366**	-	-		17,649	**17,649**
Total Proposed Budgets	34,775	42,023	6,575	19,366	**102,739**	31,876	36,982	5,596	17,649	**92,103**
Surplus/(Deficit) - Revenue	-	(650)	-	650	-	(222)	680	78	389	**925**
Cumulative variance (%)						***-0.70%***	***1.80%***	***1.37%***	***2.16%***	***0.99%***

The year to date financial position for the PHA shows an underspend against profiled budget of approximately £0.9m, mainly due to spend behind profile on Campaigns and Nursing Programme budgets (see page 4), and also a year to date underspend on Administration budgets (see page 5). It is currently anticipated that the PHA will achieve breakeven for the full year.

An allocation retraction by the DoH for £0.6m (mainly Confidence and Supply Transformation Funds) has been assumed against ringfenced budgets at this point.

** PHA Direct Programme includes amounts which may transfer to Trusts later in the year*

Programme Expenditure with Trusts



Current Trust RRLs	Belfast Trust £'000	Northern Trust £'000	South Eastern Trust £'000	Southern Trust £'000	Western Trust £'000	NIAS Trust £'000	NIMDTA Trust £'000	Total Planned Expenditure £'000	YTD Budget £'000	YTD Expenditure £'000	YTD Surplus / (Deficit) £'000
Health Improvement	4,344	2,369	1,106	1,608	1,073	-	-	**10,500**	9,563	9,625	(61)
Health Protection	1,584	1,603	1,076	1,319	1,204	-	-	**6,786**	6,159	6,221	(62)
Service Development & Screening	4,047	2,650	524	1,655	2,392	-	-	**11,268**	10,285	10,329	(44)
Nursing & AHP	1,320	709	592	1,102	977	-	-	**4,701**	4,261	4,309	(48)
Centre for Connected Health	319	420	204	164	340	-	-	**1,447**	1,321	1,327	(6)
Other	24	13	11	12	11	-	-	**72**	66	66	0
Total current RRLs	**11,638**	**7,764**	**3,515**	**5,861**	**5,997**	**-**	**-**	**34,775**	**31,655**	**31,876**	(222)
Cumulative variance (%)											***-0.70%***

	Belfast Trust £'000	Northern Trust £'000	South Eastern £'000	Southern Trust £'000	Western Trust £'000	NIAS Trust £'000	NIMDTA Trust £'000	Total Planned Expenditure £'000	YTD Budget £'000	YTD Expenditure £'000	YTD Surplus / £'000
Ringfenced	**734**	**526**	**747**	**606**	**856**	**110**	**102**	**3,680**	**3,374**	**3,374**	0
											0.00%

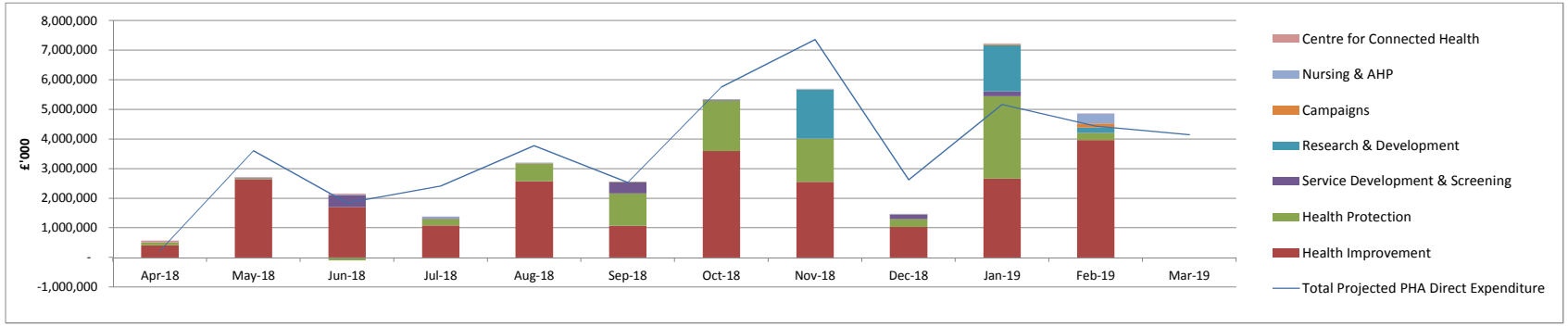
The above table shows the current Trust allocations split by budget area.

The allocation to BHSCT for Lifeline Contract has been processed during the current month, following the approval of the business case. Overall, funding allocated to Trusts is slightly ahead of the profiled budget, but this is expected to come back into line by year-end, and no overspend is anticipated.

The Other line relates to general allocations to Trusts for items such as the Apprenticeship Levy and Inflation.

Ringfenced funds allocated to Trusts have been assumed at breakeven.

PHA Direct Programme Expenditure



	Apr-18 £'000	May-18 £'000	Jun-18 £'000	Jul-18 £'000	Aug-18 £'000	Sep-18 £'000	Oct-18 £'000	Nov-18 £'000	Dec-18 £'000	Jan-19 £'000	Feb-19 £'000	Mar-19 £'000	Total £'000	YTD Budget £'000	YTD Spend £'000	Variance £'000	
Projected Expenditure																	
Health Improvement	88	3,053	1,155	2,225	3,121	1,291	2,625	3,941	1,274	2,655	1,544	2,869	**25,838**	22,970	23,336	(366)	*-1.6%*
Health Protection	56	347	93	78	446	888	2,960	1,471	1,021	809	107	1,147	**9,423**	8,276	8,371	(94)	*-1.1%*
Service Development & Screening	18	140	524	74	74	328	130	80	306	(139)	145	403	**2,084**	1,681	1,565	116	*6.9%*
Research & Development	-	-	-	-	-	-	-	1,648	-	1,563	-	170	**3,381**	3,211	3,384	(173)	*0.0%*
Campaigns	9	9	9	9	9	9	9	24	14	87	382	196	**768**	572	213	359	*-100.0%*
Nursing & AHP	17	17	20	24	130	16	34	199	15	204	155	74	**906**	832	486	346	*41.6%*
Safeguarding Board	-	-	-	-	-	-	-	-	-	-	-	10	**10**	-	-	-	*0.0%*
Centre for Connected Health	40	40	40	8	-	-	-	-	-	9	-	-	**120**	120	68	52	*43.6%*
Other	-	-	-	-	-	-	-	-	-	-	-	(914)	**(914)**	-	(440)	440	*100.0%*
Total Projected PHA Direct Expenditure	**227**	**3,607**	**1,842**	**2,418**	**3,780**	**2,533**	**5,757**	**7,363**	**2,630**	**5,171**	**2,333**	**3,954**	**41,616**	**37,662**	**36,982**	680	
Cumulative variance (%)																***1.80%***	
Actual Expenditure	**570**	**2,784**	**2,007**	**1,380**	**3,097**	**2,563**	**5,214**	**5,702**	**1,511**	**7,260**	**4,894**	**-**	**36,982**				
Variance	**(343)**	**824**	**(165)**	**1,038**	**683**	**(30)**	**543**	**1,661**	**1,119**	**(2,089)**	**(2,561)**		**680**				

Ringfenced Budgets	Apr-18 £'000	May-18 £'000	Jun-18 £'000	Jul-18 £'000	Aug-18 £'000	Sep-18 £'000	Oct-18 £'000	Nov-18 £'000	Dec-18 £'000	Jan-19 £'000	Feb-19 £'000	Mar-19 £'000	Total £'000	YTD Budget £'000	YTD Spend £'000	Variance £'000
Total Projected Ringfenced PHA Direct Expenditure	**-**	**3**	**19**	**501**	**146**	**(24)**	**373**	**156**	**415**	**76**	**635**	**1,155**	**3,455**	**2,300**	**2,222**	**78**
																3.38%
Actual Expenditure	**-**	**170**	**55**	**299**	**24**	**68**	**279**	**321**	**292**	**187**	**528**		**2,222**			
Variance	**-**	**(167)**	**(35)**	**202**	**122**	**(92)**	**94**	**(165)**	**123**	**(111)**	**107**		**78**			

The budgets and profiles are shown after adjusting for retractions and new allocations from DoH.

The year-to-date position shows a £0.7m surplus, which is mainly due to delays in payments within Campaigns (£0.4m) and Nursing (£0.3m). The Lifeline budget has been allocated to BHSCT and is now reflected in the Trust budgets on page 3. Budget managers are being reminded to closely monitor expenditure against profile to ensure full spend by year-end. The Other line shows a balancing adjustment to reflect the Administration underspend having been issued to Programme budgets to allow PHA to achieve its breakeven obligation for the year.

Ringfenced funds are showing a small underspend at the end of month 11. A breakeven position is anticipated at year end based on an assumed allocation retraction of £0.6m from Confidence and Supply Transformation Funds (see page 2).

PHA Administration

2018-19 Directorate Budgets

	Nursing & AHP £'000	Operations £'000	Public Health £'000	PHA Board £'000	Centre for Connected Health £'000	SBNI £'000	Total £'000
Annual Budget							
Salaries	3,612	2,657	11,069	173	326	484	**18,321**
Goods & Services	168	1,309	383	35	54	246	**2,195**
Savings target				(500)			**(500)**
Total Budget	**3,780**	**3,967**	**11,452**	**(292)**	**380**	**730**	**20,016**
Budget profiled to date							
Salaries	3,170	2,435	10,146	159	299	443	**16,651**
Goods & Services	146	1,077	336	(426)	51	204	**1,387**
Total	**3,316**	**3,511**	**10,481**	**(267)**	**349**	**648**	**18,038**
Actual expenditure to date							
Salaries	2,988	2,276	9,747	140	314	328	**15,794**
Goods & Services	197	978	351	2	44	283	**1,856**
Total	**3,185**	**3,255**	**10,099**	**142**	**358**	**611**	**17,649**
Surplus/(Deficit) to date							
Salaries	182	158	398	19	(16)	115	**857**
Goods & Services	(51)	98	(16)	(428)	7	(79)	**(468)**
Surplus/(Deficit)	**131**	**257**	**383**	**(410)**	**(9)**	**37**	**389**
Cumulative variance (%)	*3.95%*	*7.31%*	*3.65%*	*153.20%*	*-2.53%*	*5.67%*	***2.16%***

A savings target of £0.5m was applied to the PHA's Administration budget in 2018-19. This is currently held centrally within PHA Board, and will be managed across the Agency through scrutiny and other measures.

The year to date salaries position is showing a surplus which has been generated by a number of vacancies during the year. Senior management continue to monitor this closely in the context of PHA's obligation to achieve a breakeven position for the financial year. SBNI budget is ringfenced and any underspend will be returned to DoH prior to year end.

February 2019

Public Health Agency
2018-19 Capital Position

	Annual Budget				Year to Date			
	Programme				Programme			
	Trust	PHA Direct	Mgt & Admin	Total	Trust	PHA Direct	Mgt & Admin	Total
	£'000	£'000	£'000	£'000	£'000	£'000	£'000	£'000
Available Resources								
Capital Grant Allocation & Income	6,890	4,261	-	**11,151**	6,316	3,638	-	**9,954**
Expenditure								
Capital Expenditure - Trusts	6,890			**6,890**	6,316			**6,316**
Capital Expenditure - PHA Direct		4,261		**4,261**		2,963		**2,963**
	6,890	4,261	-	**11,151**	6,316	2,963	-	**9,279**
Surplus/(Deficit) - Capital	-	-	-	-	-	675	-	**675**
Cumulative variance (%)					*0.00%*	*18.55%*	*0.00%*	***6.78%***

PHA has received a Capital budget of £11.2m in 2018-19, most of which relates to Research & Development projects in Trusts and other organisations. A surplus of £0.7m is shown for the year to date, and a breakeven position is anticipated for the full year.

PHA Prompt Payment

Prompt Payment Statistics

	February 2019 Value	February 2019 Volume	Cumulative position as at 28 February 2019 Value	Cumulative position as at 28 February 2019 Volume
Total bills paid (relating to Prompt Payment target)	£10,097,370	643	£49,107,355	5,092
Total bills paid on time (within 30 days or under other agreed terms)	£10,009,785	625	£48,394,267	4,828
Percentage of bills paid on time	**99.1%**	**97.2%**	**98.5%**	**94.8%**

Prompt Payment performance for the year to date shows that on both value and volume the PHA is achieving its 30 day target of 95.0%. PHA is making good progress on ensuring invoices are processed promptly, and efforts to maintain this good performance will continue for the remainder of the year.

The 10 day prompt payment performance remained strong at 88.1% by value for the year to date, which significantly exceeds the 10 day DoH target for 2018-19 of 60%.

HSC Public Health Agency

item 9

Title of Meeting	PHA Board Meeting
Date	18 April 2019
Title of paper	PHA Assurance Framework 2019/20
Reference	PHA/03/04/19
Prepared by	Karen Braithwaite / Janine Waterson / Robert Graham
Lead Director	Ed McClean
Recommendation	For **Approval** ☒ For **Noting** ☐

1 Purpose

The PHA has an Assurance Framework which provides the assurances required by the PHA Board on the effectiveness of the system of internal control.

The Assurance Framework is reviewed biannually, and is brought to the PHA Board annually for approval.

2 Background Information

Good governance depends on having clear objectives, sound practices, a clear understanding of the risks associated with the organisation's business and effective monitoring arrangements.

The PHA's Assurance Framework is designed to meet these duties, taking account of Departmental guidance. It provides the systematic assurances required by the PHA Board on the effectiveness of the system of internal control by highlighting the reporting and monitoring mechanisms that are necessary in discharging our functions and duties.

The Assurance Framework has been reviewed with each Director, Finance colleagues within HSCB, and Equality and HR colleagues in BSO.

3 Key Issues

The table below highlights the main changes to the document following its last review in September 2018.

Page	Paragraph / Dimension	Amendment
1	Title	Changed to 2019/20.
3	Strategic Context	The reference to the Agency Business Plan has been updated to 2019/20.
5	Links to other PHA Policies and Documents	The reference to the Agency Business Plan has been updated to 2019/20.
7	Dimension 1 Governance Statement signed by Chief Executive	Wording altered to “Approval for Recommendation to the Board”
7	Dimension 1 Mid-Year Assurance Statement signed by the Chief Executive	Wording altered to “Approval for Recommendation to the Board”
10	Dimension 1 Information Governance Strategy	Additional wording added.
11	Dimension 1 Remuneration of Executive Directors	Updated with reference to DoH Circular and recommendation to the Board
12	Dimension 1 Minutes of Board Meetings	New item
12	Dimension 1 Board Governance Self-Assessment	New item
12	Dimension 1 Audit Committee Self-Assessment	New item
13	Dimension 1 Health and Safety, Fire Safety and Security Annual Report	New item

15	Dimension 2 Learning lessons from Serious Adverse Incident Reporting	Frequency of reporting changed and narrative updated.
16	Dimension 2 Complaints	Updated to indicate that this is contained within the Annual Report.
16	Dimension 2 Patient and Client Experience Standards and PCE Updates	Removed from Assurance Framework
16	Dimension 2 Quality Improvement Plans – Performance Management Report	Frequency of reporting to AMT changed from biannually to annually.
16	Dimension 2 Connected Health Updates	Gap noted that updates have not been brought to the Board and that this will be included in a Board calendar for 2019/20.
17	Dimension 2 HSC PPI Monitoring Report and Internal PPI Monitoring Report	Title change to merge these two items. Reporting annually to Governance and Audit Committee added. Reporting to Board changed from “approval” to “noting”.
17	Dimension 2 Health Protection Annual Reports	New item
17	Dimension 2 Research and Development Annual Report	New item
17	Dimension 2 10,000 Voices Report(s)	New item
17	Dimension 2 Annual Quality Report	New item

In addition to the changes outlined above, many of the references to the word “annual” in the frequency column have been replaced with “annually” to ensure consistency throughout the document.

4 Next Steps

This version of the Framework is subject to discussion and approval by the Governance and Audit Committee at its meeting on 17 April. Any concerns highlighted by that Committee will be brought to the attention of the Board.

Following approval, the Framework will be used to inform the agenda of future PHA Board and Committee meetings.

HSC Public Health Agency

Assurance Framework 2019-2020

Review as at April 2019

INTRODUCTION

The PHA has a duty to carry out its responsibilities within a system of effective control and in line with the objectives set by the Minister. It must also demonstrate value for money, maximizing resources to support the highest standards of service.

A key element of a system of effective control is the management of risk. It is vital the PHA discharges its functions in a way which ensures that risks are managed as effectively and efficiently as possible to meet corporate objectives and to continuously improve quality and outcomes. This means that equal priority needs to be given to the obligations of governance across all aspects of the organization whether financial, organisational or clinical and social care and for governance to be an integral part of the organisation's culture. Good governance depends on having clear objectives, sound practices, a clear understanding of the risks associated with the organisation's business and effective monitoring arrangements.

In order to meet these duties, the PHA has prepared this Assurance Framework. The framework will provide the systematic assurances required by the PHA Board on the effectiveness of the system of internal control by highlighting the reporting and monitoring mechanisms that are necessary in discharging our functions and duties.

BACKGROUND

In April 2009, DHSSPS issued 'An Assurance Framework: *A Practical Guide for Boards of DHSSPS Arm's Length bodies'.* The Framework guidance is intended to help the boards of HSC organisations improve the effectiveness of their systems of internal control, by showing how the evidence for adequate control can be marshalled, tested and strengthened within an Assurance Framework.

The HSC Paper Performance and Assurance Roles and Responsibilities (MIPB 74/09) issued in April 2009, sets out performance and assurance roles and responsibilities in relation to four key HSC domains and identifies the key functions and associated roles and responsibilities of DoH, HSCB, PHA, BSO, Trusts and other Arm's Length Bodies.

In September 2011 the then DHSSPS produced a Framework Document to meet the statutory requirements placed upon it by the Health and Social Care (Reform) Act (NI) 2009. The Framework Document describes the roles and functions of the various health and social care bodies and the systems than govern their relationships with each other and the Department. The Framework Document outlines the four performance and assurance dimensions previously introduced in the MIPB 74/09 paper.

STRATEGIC CONTEXT

The PHA is governed by Statutory Instruments: HPSS (NI) Order 1972 (SI 1972/1265 NI14), the HPSS (NI) Order 1991 (SI 1991/194 NI1), the Audit and Accountability (NI) Order 2003 and the Health and Social Care (Reform) Act (Northern Ireland) 2009.

The primary functions of the PHA can be summarised under 3 broad headings:[1]

- Improving health and social well-being and reducing health inequalities;
- Health protection;
- Professional input to commissioning of health and social care services and providing professional leadership.

In carrying out these functions the PHA also has a general responsibility for promoting improved partnership between the HSC sector and local government, other public sector organisations and the voluntary and community sectors to bring about improvements in public health and social well-being. The PHA also has a range of statutory duties in the area of Public Health and PPI under the duty to Involve and Consult. It is also responsible for the commissioning and quality assurance of existing and new screening programmes. In discharging these duties the Agency shall maintain the highest standards of decision-making. The detail of these duties is set out in various legislation, regulations or other guidance documents.

The Agency's Business Plan 2019/20 sets out the key priorities that will be taken forward by the PHA that will help to improve health and social wellbeing and protect the health of the community. The priorities and targets set have been shaped by the Departmental priorities and the longer term goals that have been set out in the PHA Corporate Plan 2017-21. The Business Plan is focused around the 5 key outcomes as set out in the Corporate Plan 2017-21. These are:

- All children and young people have the best start in life
- All older adults are enabled to live healthier and fulfilling lives
- All individuals and communities are equipped and enabled to live long healthy lives
- All health and wellbeing services should be safe and high quality
- Our organisation works effectively

[1] DHSSPS Framework Document September 2011

PHA ASSURANCE FRAMEWORK

The PHA assurance framework is based broadly around the four HSC performance and assurance dimensions as set out in the DHSSPS Framework Document (September 2011) namely:

1. Corporate Control – the arrangements by which the PHA directs and controls its functions and relates to stakeholders.

2. Safety and Quality – the arrangements for ensuring that health and social care services are safe and effective and meet patients' and client's needs.

3. Finance – the arrangements for ensuring the financial stability of the PHA, for ensuring value for money and ensuring that allocated resources are deployed fully in achievement of agreed outcomes in compliance with the requirements of the public expenditure control framework.

4. Operational Performance and Service Improvement – the arrangements for ensuring the delivery of Departmental targets and required service improvements.

The Framework Document states that "each HSC body is locally accountable for its organisational performance across the four dimensions and for ensuring that appropriate assurance arrangements are in place. This obligation rests wholly with the body's board of directors. It is the responsibility of boards to manage local performance and to manage emerging issues in the first instance."

The PHA Assurance Framework must also link with its corporate objectives and risks. An effective Assurance Framework provides a clear, concise structure for reporting key information to boards, and should be read alongside the corporate risk register to provide structured assurance about how risks are managed effectively to deliver agreed objectives.

The following tables form the basis of the Assurance Framework and have been structured according to the DOH performance and assurance dimensions, with a link to the relevant corporate objectives and primary risks.

This Assurance Framework provides the organisation with a simple but comprehensive method for effectively managing the principal risks to meet its objectives. It also provides a structure for acquiring and examining the evidence to support the Governance Statement and the Mid-Year Assurance Statement.

LINKS TO OTHER PHA POLICIES AND DOCUMENTS

The following policies and documents should be read in conjunction with the PHA Assurance Framework:

- PHA Risk Management Strategy and Policy
- PHA Corporate Risk Register
- PHA Corporate Plan 2017-21
- PHA Annual Business Plan 2019/20
- PHA Governance Framework

REVIEW AND APPROVAL

The Assurance Framework will be reviewed on a biannual basis. It will be brought to the Governance and Audit Committee for approval biannually, and the PHA board, for approval annually.

Dimension 1 – Corporate Control

The dimension of 'corporate control' encompasses the policies, procedures, practices and internal structures which are designed to give assurance that the PHA is fulfilling its essential obligations as a public body. For that reason, most of the requirements reflect those in place across the wider public sector; however, there are a number that have been instituted specifically for the field of health and social care, notably the statutory duty of care created by Article 34 of the HPSS (Quality, Improvement and Regulation) (NI) Order 2003, and the statutory duty to Involve and Consult with the recipients of health and social care created by sections 19 and 20 of the HSC (Reform) Act (NI) 2009.

The staple public sector requirements include the existence of appropriate board roles, structures and capacity; compliance with prescribed standards of public administration, national or regional policy on procurement and pay, operation of a professional internal audit service and corporate and business planning approvals. The accounting officer letter of appointment spells out the principles underlying many of these obligations, while the letters appointing chairs and non-executive members of the board also gives due emphasis to this aspect of the appointees' duties.

The table below highlights the corporate control requirements for the PHA along with how the PHA meets each obligation by way of providing assurances to the board and its Committees.

Dimension 1 – PHA Corporate Control Arrangements

Link to Corporate Objectives:
Corporate Objective 5 – Our organisation works effectively

Principal Area/ Function/Reporting Arrangement	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Governance Statement signed by Chief Executive	All risks on Corporate Risk Register	AMT	Approval	Annually	Governance and Audit Committee	Approval for Recommendation to the Board	Annually	Approval	Annually		
Mid-Year Assurance Statement signed by the Chief Executive	All risks on Corporate Risk Register	AMT	Approval	Annually	Governance and Audit Committee	Approval for Recommendation to the Board	Annually	Approval	Annually		
Corporate Plan	All risks on Corporate Risk Register	AMT	Approval	4-5 years				Approval	4-5 years		
Annual Business Plan	All risks on Corporate Risk Register	AMT	Approval	Annually				Approval	Annually		

Principal Area/ Function/Reporting Arrangement	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
An Assurance Framework to strengthen board-level control and assurance and strengthen the Governance Statement	All risks on Corporate Risk Register	AMT	Approval	Biannually	Governance and Audit Committee	Approval	Biannually	Approval	Annually, or more frequently if required		
Corporate Risk Register (supported by Directorate Risk Registers)	N/A	AMT	Approval	Annually	Governance and Audit Committee	Scrutiny and Approval	Quarterly	Noting	Annually, or more frequently if required		
PHA Annual Report	N/A	AMT	Approval	Annually	Governance and Audit Committee	Approval	Annually	Approval	Annually		
Governance and Audit Committee Annual Report	N/A				Governance and Audit Committee	Approval	Annually	Noting	Annually		
Response to DoH consultation proposals								Approval	As required		
Sealing of Documents	N/A							Approval	As required		

Principal Area/ Function/Reporting Arrangement	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Review of Standing Orders and Standing Financial Instructions	N/A	AMT	Approval	Annually	Governance and Audit Committee	Approval for Recommendation to the Board	Annually	Approval	Annually		
Register of Board Members Interests	N/A							Noting	Annually		
Gifts and Hospitality Register	N/A	AMT	Noting	Annually	Governance and Audit Committee	Noting	Annually				
Equality Scheme and subsequent review	N/A	AMT	Approval	Reviewed within 5 of submission of Scheme (27/04/2011) or its most recent review (01/04/2016) or on request by ECNI				Approval	Reviewed within 5 of submission of Scheme (27/04/2011) or its most recent review (01/04/2016) or on request by ECNI		
Equality Action Plan	N/A	AMT	Approval	Every 5 years (after 31/03/2013) or on request by ECNI				Approval	Every 5 years (after 31/03/2013) or on request by ECNI		

Principal Area/ Function/Reporting Arrangement	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Disability Action Plan	N/A	AMT	Approval	Every 5 years (after 31/03/2013) or on request by ECNI				Approval	Every 5 years (after 31/03/2013) or on request by ECNI		
Report on progress in respect of Equality and Disability duties under Section 75 of the Northern Ireland Act 1998 and Disability Section 49a of the Disability Discrimination Order (DDO) 2006	N/A	AMT	Approval	Annually				Approval	Annually		
Article 55 Review (report to Equality Commission on staffing composition)	N/A	AMT	Approval	Every 3 years				Approval	Every 3 years		
Information Governance Strategy incorporating the Information Governance Framework 2018 – 2022 ~~2015-2019~~	N/A	Information Governance Steering Group	Approval	Every 4 years	Governance and Audit Committee	Approval	Every 4 years	Approval	Every 4 years		
Information Governance Progress Reports	N/A	Information Governance Steering Group	Noting	Quarterly	Governance and Audit Committee	Noting	Quarterly	Noting	Annually		

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
PPI (Update Report)	N/A	AMT	Approval	Biannually				Approval	Biannually		
Remuneration of Executive Directors (Implementation of DoH circular)	N/A				Remuneration and Terms of Service Committee	Approval for Recommendation to the Board	Annually, where appropriate	Approval	Annually, where appropriate		
Absence Report (in Annual Report)	N/A							Noting	Annually		
Approval of new/revised PHA strategies and policies	N/A	Relevant sub-committee and AMT	Approval	As required	Relevant Committee	Approval	As required	Approval	As required		
Business Continuity Plan (Annual Review)	N/A	AMT	Approval	Annually	Governance and Audit Committee	Approval for Recommendation to the Board	Annually	Approval	Annually		
Joint Annual Report on Emergency Preparedness	N/A	AMT	Approval	Annually	Governance and Audit Committee	Approval	Annually	Approval	Annually		
Internal Audit Reports	All risks on Corporate Risk Register				Governance and Audit Committee	Noting	Quarterly				

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Mid-Year and End-Year Head of Internal Audit Report	N/A				Governance and Audit Committee	Noting	Biannually				
Internal Audit Plan	All risks on Corporate Risk Register				Governance and Audit Committee	Approval	Annually				
Minutes of Board Meetings	N/A							Approval	10 times per year (monthly excluding Jan & July)		
Minutes of Governance and Audit Committee	N/A				Governance and Audit Committee	Approval	Quarterly	Noting	Quarterly		
Minutes of Remuneration and Terms of Service Committee	N/A				Remuneration and Terms of Service Committee	Approval	Biannually	Noting (in a confidential meeting if required)	Biannually		
Board Governance Self-Assessment								Approval	Annually		
Audit Committee Self-Assessment					Governance and Audit Committee	Approval	Annually				

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Chief Executive Report	N/A							Noting	Monthly		
Health and Safety, Fire Safety and Security Annual Report	N/A	Health and Safety Committee	Annually								

Dimension 2 – Safety and Quality

The second dimension covers the arrangements whereby the PHA ensures that health and social care services, are safe and effective and meet people's needs. This covers a broad field and applies to all programmes of care and to infrastructure.

In addition to the numerous operational/professional requirements that concern or touch on safety and quality, there are more general requirements with which compliance is demanded. In the latter category, those issued by DOH include the Quality Standards[2], Care Standards, and applicable Controls Assurance standards The most notable, being the statutory duty of quality created under the HPSS (Quality, Improvement and Regulation) (NI) Order 2003.

The table below highlights the safety and quality functions required by the PHA. It also shows how the PHA meets each obligation by way of providing assurances to the board and its Committees.

[2] The Quality Standards for Health and Social Care: Supporting Good Governance and Best Practice in the HPSS (DHSSPS, March 2006)

Dimension 2 - Safety and Quality

Link to Corporate Objectives:
Corporate Objective 1 – All children and young people have the best start in life
Corporate Objective 2 – All older adults are enabled to live healthier and fulfilling lives
Corporate Objective 3 – all individuals and communities are equipped and enabled to live long healthy lives
Corporate Objective 4 – All health and wellbeing services should be high quality

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Learning lessons from Serious Adverse Incident reporting	N/A	AMT ~~(Biannual learning report)~~	Approval	Biannually ~~(biannual report and statistical analysis report presented in alternate quarters)~~	Governance and Audit Committee ~~(Six monthly analysis and learning report)~~	Noting	Biannually	Noting	Annually		
Implementation of RQIA and other independent review recommendations relevant to PHA	N/A	AMT	Noting	Biannually	Governance and Audit Committee	Noting	Biannually				
Director of Public Health Annual Report	N/A	AMT	Noting	Annually				Noting	Annually		

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Complaints (within Annual Report)	N/A	AMT	Approval	Annually, or more frequently if required	Governance and Audit Committee	Approval	Annually, or more frequently if required	Noting	Annually		
~~Patient and Client Experience Standards and PCE Updates~~	~~N/A~~	~~AMT~~	~~Approval~~	~~Biannually~~				~~Noting~~	~~Annually~~		
Quality Improvement Plans – Performance Management Report	N/A	AMT	Approval	Biannually				Approval	Annually		
Connected Health Updates	N/A	AMT	Noting	3 times a year				Noting	3 times a year	Updates have not been presented to PHA Board	Updates will be included in updated Board calendar
Family Nurse Partnership Annual Report	N/A	AMT	Approval	Annually				Approval	Annually		
Allied Health Professions Framework	N/A	AMT	Approval	Annually							

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
~~HSC~~ PPI Monitoring Report (to include PHA and HSC)	N/A	AMT	Approval	Annually	Governance and Audit Committee	Approval	Annually	Noting	Annually		
~~Internal PPI Monitoring Report~~	~~N/A~~	~~AMT~~	~~Approval~~	~~Annually~~				~~Approval~~	~~Annually~~		
Population Screening Programme Annual Reports	N/A	AMT	Approval	Annually				Approval	Annually		
Health Protection Annual Reports	N/A	AMT	Approval	Annually				Noting	Annually		
Research and Development Annual Report	N/A	AMT	Approval	Annually				Noting	Annually		
10,000 Voices Report(s)	N/A	AMT	Approval	Annually				Approval	Annually		
Annual Quality Report	N/A	AMT	Approval	Annually				Noting	Annually		

Dimension 3 – Finance

Appropriate financial accountability mechanisms are necessary to:

- Ensure that the optimum resources are secured from the Executive for Health and Social Care
- Ensure the resources allocated by Minister/Department deliver the agreed outcomes and represent value for money
- Deliver and maintain financial stability
- Facilitate the delivery of economic, effective and efficient services by rewarding planned activity that maximises effectiveness and quality and minimises cost
- Facilitate the development of innovative and effective models of care

The table below highlights the PHA finance requirements. It also identifies how the PHA meets each obligation by way of providing assurances to the board and its Committees.

Dimension 3 - Finance

Link to Corporate Objectives:
Corporate Objective 5 – Our organisation works effectively

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Finance Report from Director of Finance (HSCB)	N/A	AMT	Review and Noting	Monthly				Review and Noting	Monthly		
DoH Monitoring Returns (monthly 2-12) including information on HSC financial position, capital resource limit and expenditure, non-current assets, provisions, prompt payment statistics and cash forecast	N/A	Senior Finance Team	Review and Noting	Monthly (2-12)				Prompt payment figures now included as part of the board report	Monthly		
Response to budget proposals prepared by PHA contributed to by the Finance Department contribution to the development of Joint Commissioning Plan	N/A	AMT	Approval	Annually				Approval	As determined by DoH		

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
PHA Financial Plan (consistent with DoH principles of "Promoting Financial Stability")	N/A	AMT	Approval	Annually				Approval	Annually		
Annual Report and Accounts GAC and PHA board full accounts and supporting financial excerpt from Annual Report. AMT summary financial statements	N/A	AMT	Noting (Primary statement only at draft submission stage)	Annually	Governance and Audit Committee	For review of full draft and recommendation for approval to the Board	Annually	Approval	Annually	Not formally presented to AMT prior to the board due to time constraints	Financial Report shared in advance and full accounts shared at Board and with GAC members and Chief Executive when draft complete. Issues discussed as necessary.

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
External Audit Report to those Charged with Governance	N/A	AMT	Noting and provision of responses to recommend-ations	Annually	Governance and Audit Committee	Review and noting of recommend-ations and appraisal of management responses	Annually	Noting	Annually	Not formally presented to AMT prior to the board due to time constraints	Discussed with AMT officers for management responses.
External Audit Progress Report	N/A				Governance and Audit Committee	Review and Noting	Quarterly				
Fraud Prevention and Detection Report	N/A				Governance and Audit Committee	Noting	When appropriate – not less than once annually				
Use of External Management Consultants	N/A	AMT	Noting	Annually, or more frequently as required							
PHA capital expenditure in excess of £50,000 or £1.5m for R&D capital expenditure.	N/A	AMT	Approval or recommend-ation to the Board	As required				Approval or recommend-ation on to DoH/DoF dependant on delegated limits.	As required		

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Disposal of PHA assets in excess of £50,000	N/A	AMT	Recommendation to Board	As required				Approval	As required		

Dimension 4 – Operational Performance and Service Improvement

Performance management and service improvement arrangements are those that are necessary to ensure the achievement of Government and Ministerial objectives and targets.

The table below highlights the PHA requirements identifying how the PHA meets each obligation by way of providing assurances to the board and its Committees.

Dimension 4 – Operational Performance and Service Improvement

Link to Corporate Objectives:
Corporate Objective 1 – All children and young people have the best start in life
Corporate Objective 2 – All older adults are enabled to live healthier and fulfilling lives
Corporate Objective 3 – all individuals and communities are equipped and enabled to live long healthy lives
Corporate Objective 4 – All health and wellbeing services should be high quality
Corporate Objective 5 – Our organisation works effectively

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Performance Report (including Commissioning Direction targets and corporate objectives)	N/A	AMT	Noting	Biannually, or more frequently as required				Noting	Biannually, or more frequently as required		
Commissioning Plan	N/A	AMT	Approval	Annually				Approval	Annually		
PEMS Report	N/A	AMT	Approval	Annually, or more frequently as required				Noting	Annually, or more frequently as required		
Procurement Plan	N/A	AMT	Approval	Annually, or more frequently as required				Noting	Annually, or more frequently as required		

	Principal Risks	Existing Controls / Assurances								Gaps in Controls / Assurances	Actions to Remove Gaps
		Reports to AMT / Sub Committees / Groups			Committee of the Board (*following approval by AMT*)			The Board (*following approval by AMT*)			
		To	Purpose	Frequency	To	Purpose	Frequency	Purpose	Frequency		
Community Planning Progress Updates	N/A	AMT	Noting	Annually				Noting	Annually		
Making Life Better and Programme for Government Updates	N/A	AMT	Noting	Biannually				Noting	Biannually		

HSC Public Health Agency

item 10

Title of Meeting	PHA Board Meeting
Date	18 April 2019
Title of paper	Newborn Hearing Screening Programme Annual Report 2016-2017
Reference	PHA/04/04/19
Prepared by	Newborn Screening Team
Lead Director	Dr Adrian Mairs
Recommendation	For **Approval** ☒ For **Noting** ☐

1 Purpose

This is the first annual report of the Northern Ireland Newborn Hearing Screening Programme. The report reviews the performance of the programme from 1st April 2016 - 31st March 2017.

The report is being presented to the PHA Board for approval.

2 Background Information

Under PHA's Corporate Plan Objective 1, "All children and young people have the best start in life", there is a target that PHA will "introduce and develop antenatal and new-born screening programmes in line with the recommendations of the national and local screening committees". Part of PHA's work in this area is to produce an annual report.

One to two babies in every 1,000 is born with a hearing loss in one or both ears[1]. Research studies have demonstrated the importance of detecting a hearing loss as early as possible. The Newborn Hearing Screening Programme (NHSP) is offered to all babies, who are born or resident in Northern Ireland, up to 6 months of age. The aim of the screening programme is to identify babies with have a significant

[1]PHA Your baby's hearing screen NINHSP Information for parents accessed via: https://www.publichealth.hscni.net/sites/default/files/ENGLISH%20%20L1%20%20Your%20Baby%27s%20Hearing%20Screen%20%28Well%20Baby%29.pdf

permanent childhood hearing loss[2] to allow early referral, diagnosis and intervention. Early detection and effective interventions result in improved outcomes for children.

Programme Delivery

The NHSP is commissioned and quality assured by the Public Health Agency (PHA) in collaboration with the five Health and Social Care Trusts (HSCTs) in Northern Ireland, who manage and deliver the programme. It is a complex programme involving a wide range of professional staff including local newborn hearing screening co-ordinators, hearing test screeners, child health system staff, midwives, paediatric staff, neonatal and special care baby unit staff, health visitors, community and hospital audiology and ear, nose and throat (ENT) specialist staff.

Screening tests

The programme follows two separate screening protocols (outlined in detail in appendices 1 and 2) depending on whether a baby has been in a neonatal/special care baby unit for more than 48 hours prior to screening.

There are also two types of hearing screening tests provided. The type of test that a baby requires and is offered will depend on (a) which screening protocol is applicable (see appendix 1 and 2) and (b) the results of their initial test if they have been following a well baby/early discharge protocol.

3 Key Issues

During 2016-17 there were a number of developments within the NHSP, most notably scoping the potential to procure a regional managed IT service to support the programme and enhance current data processing and quality assurance practice.

The key highlights of the NHSP during 1st April 2016 – 31st March 2017 include that:

- There were 23,936 'current residents' (i.e. babies) eligible for screening. Of these:
    - 99.6% (23,830) were offered screening
    - 96.8% (23,167) completed screening by the age of 4 weeks; this increased to 98.9% (23,675) by 3 months
    - 2% (467) were referred by the age of 3 months to audiology services for diagnostic assessment.

[2] 'NHSP defines this as a bilateral permanent hearing loss averaging ≥ 40dBnHL across 0.5 to 4kHz". Sutton et al Guidelines for surveillance and audiological referral of infants & children following the newborn hearing screen, July 2012.

In relation to ‘live births’ in hospitals in Northern Ireland during the same period:

- 72.9% (17,577/24,127) of babies had their hearing screening test completed before discharge from hospital.

4 Next Steps

This finalised report will be published and publically available on the PHA website. The 2017-18 annual report will be produced by June 2019.

Newborn Hearing Screening in Northern Ireland

Annual Report 2016 - 17

HSC Public Health Agency

Newborn Hearing Screening Programme

CONTENTS:

Executive Summary

Background

One to two babies in every 1,000 is born with a hearing loss in one or both ears[1]. Research studies have demonstrated the importance of detecting a hearing loss as early as possible. The Newborn Hearing Screening Programme (NHSP) is offered to all babies, who are born or resident in Northern Ireland, up to 6 months of age. The aim of the screening programme is to identify babies with who have a significant permanent childhood hearing loss[2] to allow early referral, diagnosis and intervention. Early detection and effective interventions result in improved outcomes for children. This is the first annual report of the Northern Ireland NHSP and summarises the performance of the programme from 1st April 2016- 31st March 2017.

Programme Delivery

The NHSP is commissioned and quality assured by the Public Health Agency (PHA) in collaboration with the five Health and Social Care Trusts (HSCTs) in Northern Ireland, who manage and deliver the programme. It is a complex programme involving a wide range of professional staff including local newborn hearing screening co-ordinators, hearing test screeners, child health system staff, midwives, paediatric staff, neonatal and special care baby unit staff, health visitors, community and hospital audiology and ear, nose and throat (ENT) specialist staff.

[1] PHA Your baby's hearing screen NINHSP Information for parents accessed via: https://www.publichealth.hscni.net/sites/default/files/ENGLISH%20%20L1%20%20Your%20Baby%27s%20Hearing%20Screen%20%28Well%20Baby%29.pdf

[2] 'NHSP defines this as a bilateral permanent hearing loss averaging ≥ 40dBnHL across 0.5 to 4kHz". Sutton et al Guidelines for surveillance and audiological referral of infants & children following the newborn hearing screen, July 2012.

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The programme follows two separate screening protocols (outlined in detail in appendices 1 and 2) depending on whether a baby has been in a neonatal/special care baby unit for more than 48 hours prior to screening.

There are also two types of hearing screening tests provided. The type of test that a baby requires and is offered will depend on (a) which screening protocol is applicable (see appendix 1 and 2) and (b) the results of their initial test if they have been following a well baby/early discharge protocol.

Key developments

During 2016-17 there were a number of developments within the NHSP, most notably scoping the potential to procure a regional managed IT service to support the programme and enhance current data processing and quality assurance practice.

Headline results

The key highlights of the NHSP during 1st April 2016 – 31st March 2017 include that:

- There were 23,936 'current residents' (i.e. babies) eligible for screening. Of these:
    - 99.6% (23,830) were offered screening
    - 96.8% (23,167) completed screening by the age of 4 weeks; this increased to 98.9% (23,675) by 3 months
    - 2% (467) were referred by the age of 3 months to audiology services for diagnostic assessment.

In relation to 'live births' in hospitals in Northern Ireland during the same period:

72.9% (17,577/24,127) of babies had their hearing screening test completed before discharge from hospital.

BACKGROUND

Screening is defined as 'the process of identifying healthy people who may have an increased chance of a disease or condition and offering them information, screening tests and, if required, further confirmatory (diagnostic) tests and treatment'[3]. The aim of screening is to reduce the problems and complications associated with the underlying disease / condition.

Following the recommendation from the UK National Screening Committee (UKNSC) that a national neonatal hearing screening programme should be established, the Northern Ireland Newborn Hearing Screening Programme (NHSP) was launched in October 2005.

Hearing screening is offered to all babies, who are born or resident in Northern Ireland, up to 6 months of age (i.e. from birth (day 0) until day 182 of life inclusive). This is the first annual report of the Northern Ireland NHSP and summarises the performance of the programme from 1st April 2016- 31st March 2017.

Aim of newborn hearing screening

One to two babies in every 1,000 is born with a hearing loss in one or both ears. Research studies have demonstrated the importance of detecting a hearing loss as early as possible. The aim of the NHSP is to identify babies who have a significant permanent childhood hearing loss[4], i.e. a bilateral hearing loss of 40

[3] PHE Screening explained https://www.gov.uk/guidance/nhs-population-screening-explained

[4] 'NHSP defines this as a bilateral permanent hearing loss averaging ≥ 40dBnHL across 0.5 to 4kHz" Sutton et al *Guidelines for surveillance and audiological referral of infants & children following the newborn hearing screen*, July 2012.

dBnHL or more[5], in order to detect permanent childhood hearing impairment (PCHI) at the earliest stage, ideally within 4 weeks of birth. This allows timely referral, diagnosis and intervention. Early detection and effective interventions result in improved outcomes for children, in particular, normal speech and language development.

Programme delivery

In Northern Ireland the NHSP is commissioned and quality assured by the Public Health Agency (PHA) in collaboration with the five Health and Social Care Trusts (HSCTs), who manage and deliver the programme. It is a complex programme involving a wide range of professional staff including local newborn hearing screening co-ordinators, screeners, Child Health System staff, midwives, paediatric staff, neonatal and special care baby unit staff, health visitors, community and hospital audiology and ear, nose and throat (ENT) specialist staff.

Screening pathway

Offer of screening

All babies resident in Northern Ireland (including those born in or who have moved in to NI) are offered screening from over 34 weeks gestational age up until the age of 6 months[6].

Exclusions

For some babies hearing screening can be inappropriate if the infant has a condition, including atresia, bacterial meningitis or temporal bone fracture, which requires direct referral for diagnostic testing, or if the infant is receiving palliative care and screening is not therefore indicated.

[5] Davis A, Bamford J, Wilson I, Ramkalawan T, Forshaw M - A critical review of the role of neonatal hearing screening in the detection of congenital hearing impairment. Health Technol Assess 1997;1(10)

[6] 6 months is defined as day 182 of life, with birth being day 0

Screening protocols and tests

The programme follows two separate screening protocols (outlined in detail in appendices 1 and 2) depending on whether a baby has been in a neonatal/special care baby unit for more than 48 hours prior to screening. This is because babies who have spent at least 48 hours in a special care unit have a slightly increased risk of hearing loss. Whilst About 1 in every 900 babies has hearing loss in one or both ears, this increases to about 1 in every 100 babies who have spent at least 48 hours in a special care unit[7].

There are also two types of hearing screening tests provided. The type of test that a baby requires and is offered will depend on (a) which screening protocol is applicable (see appendix 1 and 2) and (b) the results of their initial test if they have been following a well baby/early discharge protocol.

A baby's newborn hearing screening test is often conducted prior to discharge from hospital, but can also be performed following discharge at an outpatient clinic. The screening tests are described below.

- Automated Otoacoustic Emission (AOAE)

An **AOAE** test involves placing a small soft tipped earpiece in the outer part of a baby's ear to send clicking sounds to the inner ear. Using a computer, the screener carrying out the test can detect how the baby's inner ear responds to sound. The test causes no discomfort to the baby and is often conducted while they are asleep. This test measures the mechanical function of the inner ear. In the cochlea, when a noise is heard, acoustic energy is generated which will cause vibration of hair cells in the inner ear (these are known as otoacoustic

[7] PHE *Babies in special care units: screening tests for you and* your babies (Information leaflet) accessed at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/712824/NICU1_Babies_in_special_care_units_Screening_tests_for_you_and_your_baby.pdf

emissions). The AOAE test screens for these otoacoustic emissions. All babies are offered this test.

- Automated Auditory Brainstem Response (AABR)

An **AABR** is a different type of test. Rather than measure acoustic energy within the inner ear, it measures electrical brain activity. This screening test involves placing small sensors on a baby's head, shoulder and nape of the neck. Soft headphones are placed over baby's ears and a series of clicking sounds are played. A computer measures how baby's ears respond to these sounds. This test is usually not required for all babies.

Referral

Depending on the results of these screening tests, a child may require referral for further specialist assessment by audiology services. This is to confirm a diagnosis and allow timely follow up and treatment if required.

Hearing loss

It is, however, important to remember that no screening test is 100% accurate and also that hearing loss can occur at any stage of life. It is therefore important that parents remain vigilant for any changes or concerns regarding their child's hearing.

A developmental checklist (see appendix 3) is shared with parents via the Personal Childhood Health Record (PCHR), to encourage monitoring of their baby's hearing throughout the early stages of life. Should a parent/guardian have any concern about hearing, this can be discussed with the health visitor or GP

Risk factors and 'targeted' follow up

As outlined above, hearing loss can occur at any time in childhood, even in the absence of specific risk factors. The prevalence of hearing loss is higher among infants who have one or more of the following known risk factors:

Congenital Infection	Proven or possible congenital infection due to toxoplasmosis, rubella, cytomegalovirus (CMV) or herpes as determined by TORCH[8] screen, and notified at any age.
Craniofacial Anomalies	A (noticeable) craniofacial anomaly (excluding minor pits and ear tags) at any age, e.g. cleft palate.
Syndrome	Confirmed syndrome related to hearing loss, e.g. Down's syndrome.
NNU[9] protocol results	Bilateral clear response at AABR and the infant has not acquired a clear response in at least one ear at AOAE.

At the time of newborn hearing screening, a child identified as having one or more of these known, nationally agreed, risk factors for hearing loss, is referred for a further hearing assessment at the age of 8 months, regardless of their hearing screening result.

[8] a TORCH screen is a blood test used to screen for a number of infectious diseases that are known by the acronym TORCH – Toxoplasmosis, Other agents (including syphilis and HIV), Rubella, Cytomegalovirus and Herpes simplex

[9] NNU = neonatal unit

Failsafe

A failsafe is a back-up mechanism which, in addition to usual care, ensures that if something does not go to plan in the screening pathway, the back-up process identifies what has happened and initiates appropriate action.

The NHSP includes a robust mechanism to capture babies who have not been offered, or taken part, in screening. This failsafe 'mop up' report identifies all babies from age 14 days until age 182 days (i.e. for the duration of the programme) with a nil or inconclusive result. The report is run each week by the NHSP Coordinator in each Trust, using the Child Health Information System. Once a baby has been identified on this list, their parent/guardian will be contacted to offer a screening hearing test.

Key developments 2016-17

During 2016-17 there were a number of developments within the NHSP, most notably scoping out the potential to procure a managed regional IT service to support the programme and enhance current data processing and quality assurance practice. Currently, results from screening tests are recorded on handwritten daily worklists which are input into the Child Health System.

The screening programme has identified the considerable advantages associated with a bespoke IT infrastructure that would reduce the need for manual entry of data. An electronic mechanism would facilitate an automated capture and retention of NHSP screening results. This would support patient management and allow data reporting against national standards, which is limited at present. Significant business processes to procure this system occurred during 2016-17, including engagement with regional stakeholders and service providers in order to shape the implementation of this complex system.

The programme also continues to utilise published information from the 'Northern Ireland Health and Social Care Interpreting Service' as a guide to

ensure that the most up-to-date translated leaflets are provided to service users. Translated leaflets are currently available in multiple languages.

Programme performance 2016-17

The NHSP routinely collects and collates data to measure and monitor programme performance. The procurement of a managed IT service will improve the data reports that can be produced, including in relation to timeliness of diagnostic assessment and outcomes in line with national standards.[10]

Programme data

- Cohort: data is produced on the offer, uptake and outcome of newborn hearing screening of:
    - 'Livebirths' before discharge from hospital and
    - 'Current residents'
- Key definitions:
    - 'Livebirths' – this includes all babies who were born alive in hospitals in Northern Ireland from 1st April 2016 to 31st March 2017.
    - 'Current residents' – this includes all babies who were:
        - born between 1st April 2016 and 31st March 2017 and
        - were resident in Northern Ireland, at some point, between 1st April 2016 and 31st March 2017.
    - The current resident cohort may include babies who were not born in hospital, or who were born outside

[10] PHE NHS Newborn Hearing Screening Programme Standards 2016 to 2017 available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685452/NHSP_Standards_2016_-_17.pdf

Northern Ireland and moved into Northern Ireland within the first six months of life. It may also vary from the total number of 'live births' as children may have been born in Northern Ireland hospitals but moved out of Northern Ireland.

- *Source*: Data on the performance of the programme is provided by the Child Health System (CHS). There are four CHS areas in Northern Ireland and these collectively cover the five health and social care trust geographies, i.e. Eastern (Belfast Health and Social Care Trust and South Eastern Health and Social Care Trust), Northern (Northern Health and Social Care Trust), Southern (Southern Health and Social Care Trust) and Western (Western Health and Social Care Trust).

- *Frequency of reporting*: data is produced quarterly to cover the periods April to June, July to September, October to December and January to March. The reports that produce the data for a given quarter are run four months after the end of a quarter.

- *Methodology*: the annual figures included in this report have been calculated by summing the figures in each quarter.

Headline results

Regional data relating to the NI Newborn Hearing Screening Programme highlights that from 1st April 2016 – 31st March 2017:

- There were 23,936 'current residents' eligible for screening. Of these:
    - 99.6% (23,830) were offered screening
    - 96.8% (23,167) completed screening by the age of 4 weeks; this increased to 98.9% (23,675) by 3 months

- 2% (467) were referred by the age of 3 months to audiology services for diagnostic assessment.

In relation to 'live births' in hospitals in Northern Ireland during the same period:

- 72.9% (17,577/24,127) of babies had hearing screening completed before discharge from hospital**.**

Trends in data

Figure 1 shows that in 2016-17, as in 2014-15 and 2015-16, over 99% of current residents were offered hearing screening and 98.9% had completed screening by 3 months of age. As outlined above, babies may decline screening, or in some instances screening may not be appropriate.

Figure 1: Proportion of 'current residents' in NI offered newborn hearing screening and completion rates by 4 weeks and 3 months of age 2014-17

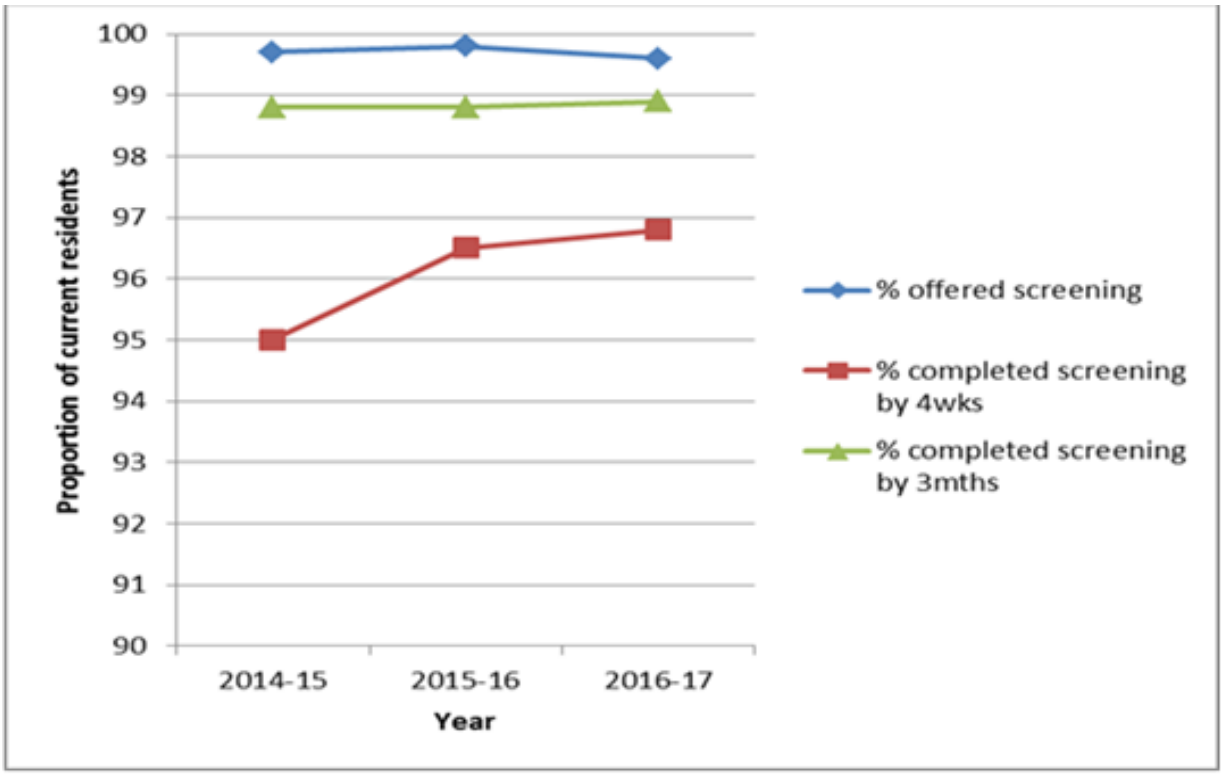


Table 1: Proportion of 'current residents' in NI offered newborn hearing screening and completion rates by 4 weeks and 3 months of age 2014-17

Year	Number of current residents	No. offered screen	% offered	No. completed by		% completed by	
				4 wks	3mths	4wks	3mths
2014-15	24149	24073	99.7	22944	23859	95.0%	98.8%
2015-16	24190	24130	99.8	23340	23901	96.5%	98.8%
2016-17	23936	23830	99.6	23167	23675	96.8%	98.9%

Table 2 shows that from 2014-2017 there has also been a consistently high proportion of current residents (>98%) who have completed screening by 3 months of age. Of these, approximately 2% per year require referral to audiology services for further testing following the result of their screening test.

Table 2: Proportion of 'current residents' in NI with screening outcome (bilateral clear response or referral for ABR) by 4 weeks and 3 months of age 2014-17

Year	**Number of current residents**	**by 4 weeks**			**by 3 months**		
		% completed	**% with BCR**	**% referred**	**% completed**	**% with BCR**	**% referred**
2014-15	24149	95.0% (22944)	93.1% (22482)	1.9% (462)	98.8% (23859)	96.7% (23351)	2.1% (508)
2015-16	24190	96.5% (23340)	94.5% (22856)	2.0% (484)	98.8% (23901)	96.7% (23390)	2.1% (511)
2016-17	23936	96.8% (23167)	95.0% (22730)	1.8% (437)	98.9% (23675)	97.0% (23208)	2.0% (467)

Data from 2014-17 (table 3) also indicates that >70% of babies born alive in hospitals in Northern Ireland per year completed hearing screening before discharge from hospital.

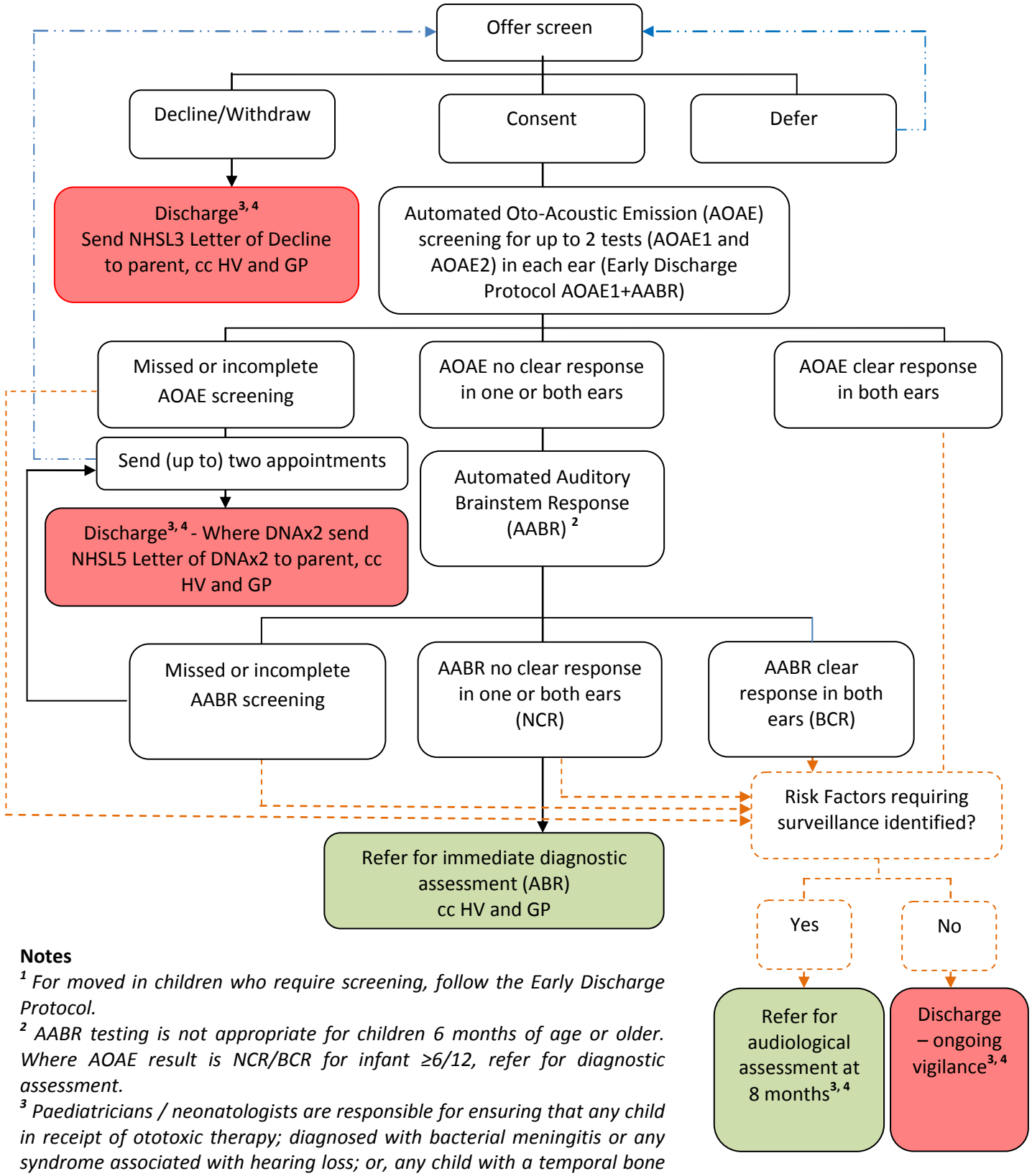
Table 3: Proportion of 'livebirths' in NI offered and completed hearing screening before discharge from hospital 2014-17

Year	Number of livebirths	No. completed screen before discharge	% completed screen before discharge
2014-15	24438	17574	71.9%
2015-16	24480	17786	72.7%
2016-17	24127	17577	72.9%

Appendix 1: Northern Ireland Newborn Hearing Screening Programme

Well Baby / Early Discharge Protocol - Patient Journey

Residents (including moved in children) up to 6 months of Age[1]



Notes

[1] For moved in children who require screening, follow the Early Discharge Protocol.

[2] AABR testing is not appropriate for children 6 months of age or older. Where AOAE result is NCR/BCR for infant ≥6/12, refer for diagnostic assessment.

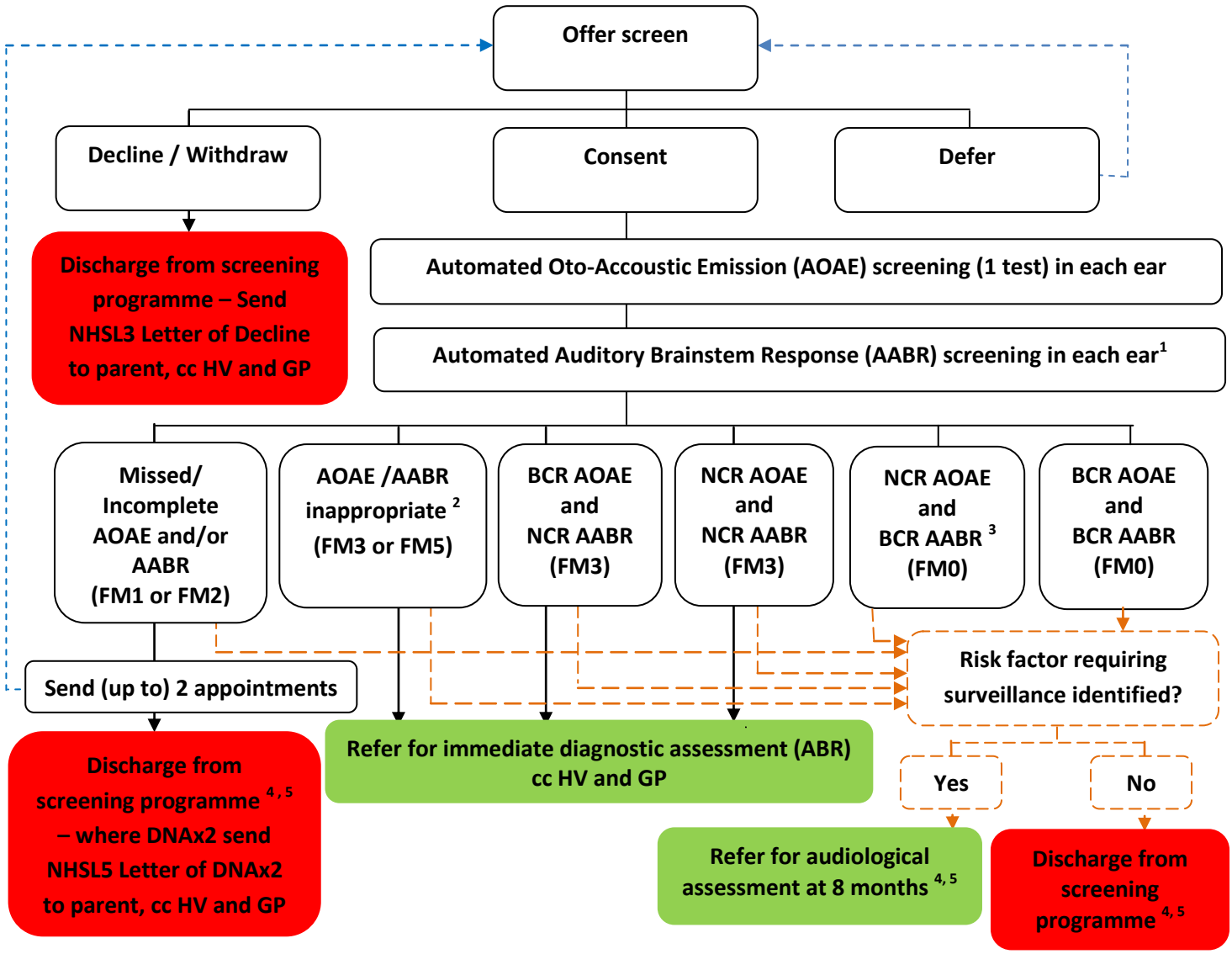
[3] Paediatricians / neonatologists are responsible for ensuring that any child in receipt of ototoxic therapy; diagnosed with bacterial meningitis or any syndrome associated with hearing loss; or, any child with a temporal bone fracture is referred immediately for diagnostic assessment (irrespective of whether newborn hearing screening has taken place or the results of newborn hearing screening).

[4] Children should be referred for appropriate audiological assessment where there is any parental or professional concern.

Appendix 2: Northern Ireland Newborn Hearing Screening Programme

NICU/SCBU (> 48hrs) Protocol – Patient Journey

Residents (including moved in infants) up to 6 months of age



Notes

[1] *AABR testing is not appropriate for children who are 6 months of age or older. Where an AOAE result is NCR and the child has reached 6 months of age or older, refer for diagnostic assessment.*

[2] *Screening can be inappropriate because an infant has a condition, e.g. atresia, and requires direct referral for neurological ABR testing (FM3), or where an infant is receiving palliative care and screening is not indicated and referral for ABR is not required (FM5). Where (FM3) infants are seen by screeners before referral, risk assessment should be carried out, but risk factors should not be assessed where an infant is receiving palliative care (FM5).*

[3] *This outcome is Risk Factor 10 and infants are automatically referred for audiological assessment at 8 months.*

[4] *Paediatricians / neonatologists are responsible for ensuring that any child in receipt of ototoxic therapy; diagnosed with bacterial meningitis or any syndrome associated with hearing loss; or, any child with a temporal bone fracture is referred immediately for diagnostic assessment (irrespective of whether newborn hearing screening has taken place or the results of newborn hearing screening).*

[5] *Children should be referred for appropriate audiological assessment where there is any parental or professional concern.*

Screening Outcomes: BCR – clear response achieved in both ears; or
NCR – no clear response in one or both ears

Further Management Codes: FM0 – no further action;
FM1 – for first screen;
FM2 - for further screen;
FM3 – refer for ABR test (to diagnostic audiology); and,
FM5 – not indicated

Appendix 3

YOUR BABY'S DEVELOPMENT (HEARING, SPEECH AND LANGUAGE)

Extracted from the Northern Ireland Personal Child Health Record (PCHR – 'red book') for translation of newborn hearing screening programme information. The full version of 'Your Baby's Development' is available within the PCHR, pages 10-14 (revised 2014).

Birth to 8 weeks

- Is startled by sudden loud noises, e.g. a hand clap or a door slamming.
- Blinks or opens eyes widely, stops sucking or starts to cry at loud noises.
- Pauses, appears to listen and may turn towards sudden ongoing sounds when they begin, e.g. a vacuum cleaner.

9-16 weeks

- Quietens or smiles to familiar voices even when unable to see speaker. Turns eyes or head towards voice. Shows excitement at sounds, e.g. voices, footsteps.
- Makes soft sounds when awake. Gurgles and coos.

5-9 months

- Makes laughter-like and sing-song sounds. e.g. 'a-a', 'muh', 'goo', 'der', 'aroo', 'adagh'.
- Turns immediately to familiar voices across the room or to very quiet noises on each side (if not too occupied with other things).
- Listens closely to familiar everyday sounds and looks for very quiet sounds made out of sight. Makes sounds to show friendliness or annoyance.
- Babbles, e.g. 'da da da', 'ma ma ma', 'ba ba ba'. Shows pleasure in babbling loudly and tunefully in response to others. Starts to copy other sounds like coughing or smacking lips.

9-12 months

- Shows some response to own name.

- Babbles loudly, often making sounds with rhythm that sound like a simple conversation.
- Responds to words like ‘no’ and ‘bye bye’ even when the speakers gestures cannot be seen.
- Waves ‘bye bye’ and claps hands.
- Around 12 months, may use 1 or 2 words.

1-2 years

- Around 15 months, makes lots of speech like sounds. Uses 2-6 words correctly that you understand, e.g. ‘teddy’ when seeing or wanting a teddy bear.
- Around 18 months, when playing, makes speech-like sounds with rhythm that sound like a simple conversation. Uses 6-20 words that you understand. Follows simple instructions, e.g. ‘show me your shoes’.
- Finds and points to pictures in books by using words ‘look’ and ‘see’. Turns pages one at a time.
- Around 24 months, uses 50 or more words correctly that you understand. Puts 2 or more words together to make simple sentences, e.g. ‘more milk’. Joins in nursery rhymes and songs. Talks to self during play – speech may be unclear to others.

2-3 years

- Around 30 months, uses 200 or more words that you understand. Uses pronouns, e.g. ‘I’, ‘me’ and ‘you’. Uses sentences but many will lack adult structure. Talks to self during play. Asks questions. Says a few nursery rhymes.
- Around 36 months, uses a large number of words – speech is clear to familiar listeners.

3-5 years

- Speech is clear to unfamiliar listeners. Around 4-5 years, talks in sentences, where words and grammar are mostly in the correct order.

References: B. McCormick, Children's Hearing Assessment Centre, Nottingham, UK – 'Can Your Baby Hear You?' (1982)
Mary D. Sheridan – 'Birth to Five Years' (1997)

Other translations of this leaflet are available to view/download at:

https://www.publichealth.hscni.net/publications/newborn-hearing-screening-english-and-translations

Reproduced by the Northern Ireland Newborn Hearing Screening Quality Management Group

January 2015

ACKNOWLEDGEMENTS:

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item 11

Title of Meeting	PHA Board Meeting
Date	18 April 2019
Title of paper	Annual Vaccine Preventable Diseases Report for Northern Ireland 2019
Reference	PHA/05/04/19
Prepared by	Dr Jillian Johnston
Lead Director	Dr Adrian Mairs
Recommendation	For **Approval** ☐ For **Noting** ☒

1 Purpose

This is the second "Annual Vaccine-Preventable Diseases report for Northern Ireland 2019: an analysis of data for the calendar year 2018", collated by the Vaccine-Preventable Disease (VPD) Surveillance Team of the Health Protection Directorate.

The report is being brought to the PHA Board for noting prior to publication in the public domain.

2 Background Information

Under PHA's Corporate Plan Objective 1, "All children and young people have the best start in life", and Objective 2, "All older adults are enabled to live healthier and more fulfilling lives", PHA will maintain and improve vaccination programmes. This report forms part of that work.

3 Key Issues

The report provides an overview of the epidemiology of VPDs covered by childhood and adult vaccination programmes, including meningococcus, pneumococcus, haemophilus influenzae, pertussis, measles, mumps, rubella, diphtheria, tetanus and poliomyelitis.

Overall, the burden of disease from vaccine-preventable infections is low in Northern Ireland. This is undoubtedly due to the success of regional vaccination programmes that continue to experience high levels of uptake across the region.

4 Next Steps

Following this meeting the Report will be published on the PHA website.

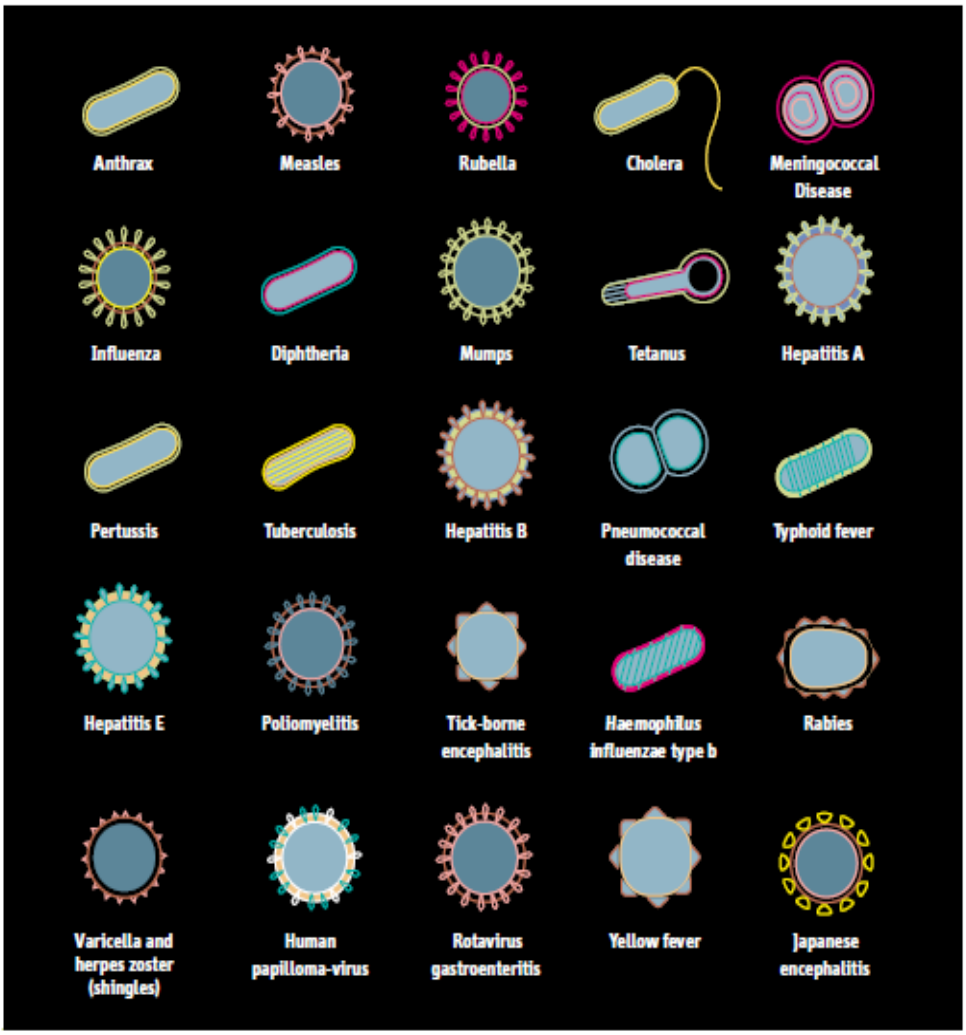
To enable reporting on a timelier basis the Immunisation Team now presents information on regional immunisation programmes in Northern Ireland in two separate reports:

- "*Annual Vaccine-Preventable Diseases report for Northern Ireland*" will provide epidemiological information for the calendar year and continue to be published in April of the following year

- "*Annual Immunisation Report for Northern Ireland*" will provide information on coverage of immunisation programmes and will be published in early November - the earliest date possible following collection of data from vaccine programmes delivered in schools.

Annual Vaccine Preventable Diseases Report for Northern Ireland 2019

An analysis of data for the calendar year 2018



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Acknowledgements

The Public Health Agency Health Protection Directorate Vaccine Preventable Disease Surveillance Team would like to thank everyone across Northern Ireland who reports cases of vaccine-preventable diseases. This information enables us to assess the burden of disease across the region and evaluate the impact of our national vaccination programmes. This includes GPs, hospital clinicians, paediatricians, staff in Health and Social Care Trust laboratories, the Regional Virology Laboratory and the Public Health England National Reference Centres and PHA communications team.

The front cover image, taken from the WHO *Global Vaccine Action Plan 2011-2020*, represents all bacteria and viruses for which a vaccine is available, highlighting what a valuable and growing resource vaccines are across the world to protect against infectious diseases[1]. Not all of these vaccines are routinely used in Northern Ireland as vaccine recommendations are based on the local epidemiology of vaccine preventable diseases.

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April 2019

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Cover image used with permission from WHO *Global Vaccine Action Plan 2011-2020*[1] - http://apps.who.int/iris/handle/10665/78141
http://www.who.int/immunization/global_vaccine_action_plan/GVAP_doc_2011_2020/en/
ISBN 9789241504980 – Page 17, table 1: vaccine-preventable infectious agents or diseases

Contents

Summary

Invasive Meningococcal Disease

- 26 clinically suspected notifications, with 17 (65%) laboratory confirmed cases; a decrease of 28% and 19% respectively since 2017 (36 notifications; 21 confirmed cases)
- Median age of cases 16 years (1 month to 84 years), with age-specific incidence highest in children 4 years of age and under (7.3 per 100,000 population)
- Of the 17 laboratory confirmed cases, 71% (12) serotype B, with the remainder <5 in serotype C, W135 and Y

Invasive Pneumococcal Disease

- 171 laboratory confirmed cases; largely unchanged since 2017 (173)
- Cases over 45 years of age accounted for 77% of cases, with the majority of these over 65 years
- Of the 88 laboratory confirmed cases with typing, 80% of cases due to strains not included in the pneumococcal conjugate vaccine (PCV13)

Invasive Haemophilus Influenzae Disease

- 49 laboratory confirmed cases; an increase of 58% when compared to 2017 (31)
- Cases over 15 years of age accounted for 59% of cases
- Of the 17 cases with typing 82% were non capsulated strains with the remaining capsulated non-B strains

Pertussis

- 37 laboratory confirmed cases; a decrease of 49% since 2017 (72)
- The majority (51%) were in those over 25 years of age

Measles, Mumps, Rubella

- 29 notifications of clinically suspected measles, all of which were discarded on measles testing
- Less than five notifications of clinically suspected rubella, all of which were discarded on rubella testing
- 66 laboratory confirmed cases of mumps, a 65% decrease from 2017 (191), with the majority of cases in 15-24 years (53%;) and fully vaccinated with MMR vaccine

Introduction

Vaccine programmes have been a huge success in reducing the burden of Vaccine-Preventable Diseases (VPDs) globally. According to the *WHO Global Vaccine Action Plan 2011-2020*, "Overwhelming evidence demonstrates the benefits of immunisation as one of the most successful and cost-effective health interventions known". Their vision for the Decade of Vaccines (2011–2020) is of a world in which all individuals and communities enjoy lives free from vaccine-preventable diseases.

This Annual Surveillance report 2019 provides an overview of the epidemiology of VPDs in Northern Ireland for the calendar year 2018. This information is used to inform public health actions for individual cases, identify outbreaks, assess the burden of disease in Northern Ireland and contribute to national and European monitoring of disease burden and vaccine effectiveness.

Epidemiological information is presented for

- Invasive Meningococcus Disease
- Invasive Pneumococcus Disease
- Invasive Haemophilus Influenzae Disease
- Pertussis (whooping cough)
- Measles
- Mumps
- Rubella
- Diphtheria, Tetanus and Poliomyelitis

Epidemiological information on other infections preventable by vaccination can be found in PHA disease specific surveillance reports, including: influenza virus, rotavirus, hepatitis B, genital warts secondary to human papilloma virus (HPV) and tuberculosis secondary to mycoplasma bacterium [2,3,4,5].

Data Sources

The VPD Surveillance Team collects and collates epidemiological data on VPDs throughout the year to analyse local trends of frequency, incidence rates, age distribution and serotype characterisation. Data is collected from the following sources:

Notification of Infectious Diseases (NOIDs):

Registered medical practitioners have a statutory duty to notify the PHA Health Protection Duty Room of clinically suspected cases of certain infectious diseases[6]. Notifications are collated on the Health Protection electronic software system, HP Zone® by PHA Duty Officers. The surveillance team extracts required information from HP Zone® on VPD NOIDs.

Laboratory reports from Health and Social Care Trusts (HSCT):

HSCT Laboratories performing a primary diagnostic role voluntarily report confirmed cases of infectious disease to the surveillance team through electronic software (CoSurv®). HSCT Laboratories report microbiological culture results for meningococcal, pneumococcal and haemophilius influenza infections and, if performed, serological results for pertussis infection. Urgent reports are sent by telephone or email to the duty room. Those that are notifiable infections are collated on HP Zone® by PHA Duty Officers and required information extracted for surveillance.

Laboratory reports from Regional Virology Laboratory (RVL):

HSCT laboratories transfer all specimens for clinically suspected cases of measles, rubella, mumps or enterovirus for Polymerase Chain Reaction (PCR) testing to the Regional Virology Laboratory. They also may voluntarily submit specimens for PCR testing of bacterial VPDs. RVL voluntarily reports confirmed PCR cases through CoSurv®. Urgent reports are sent by telephone or email to the PHA Duty Room.

Those that are notifiable infections are collated on HP Zone® by PHA Duty Officers with required information extracted for surveillance purposes.

Laboratory reports from National Reference Laboratories:

HSCT Laboratories and RVL voluntarily submit positive isolates to Public Health England (PHE) National Reference Laboratories. HSCT Laboratories may also voluntarily submit specimens for PCR testing of bacterial VPDs. The surveillance team collates PHE laboratory reports on serotype characterisation and other specialist testing.

The Meningococcal Reference Unit in Manchester is the national reference laboratory for meningococcal disease. The Respiratory and Vaccine Preventable Bacteria Reference Unit (RVPBRU) provides respiratory, systemic and vaccine-preventable bacteria and serodiagnostic testing for diphtheria, tetanus and bordetella pertussis immunity. The Immunisation and Diagnostic Unit (IDU) provides testing for rash associated viral and neurological infections, including measles, mumps and rubella.

Enhanced surveillance systems:

Following introduction of the meningococcal C conjugate vaccine and pneumococcal conjugate vaccine programmes, since 1999 and 2006 respectively, enhanced epidemiological information has been collected across the United Kingdom to monitor vaccine programme effectiveness. Information collected includes clinical status, vaccination status and severity indicators.

Denominator Data:

Incidence rates were calculated with 2017 mid-population estimates obtained from Northern Ireland Statistics and Research Agency (NISRA). www.nisra.gov.uk/publications/2017-mid-year-population-estimates-northern-ireland

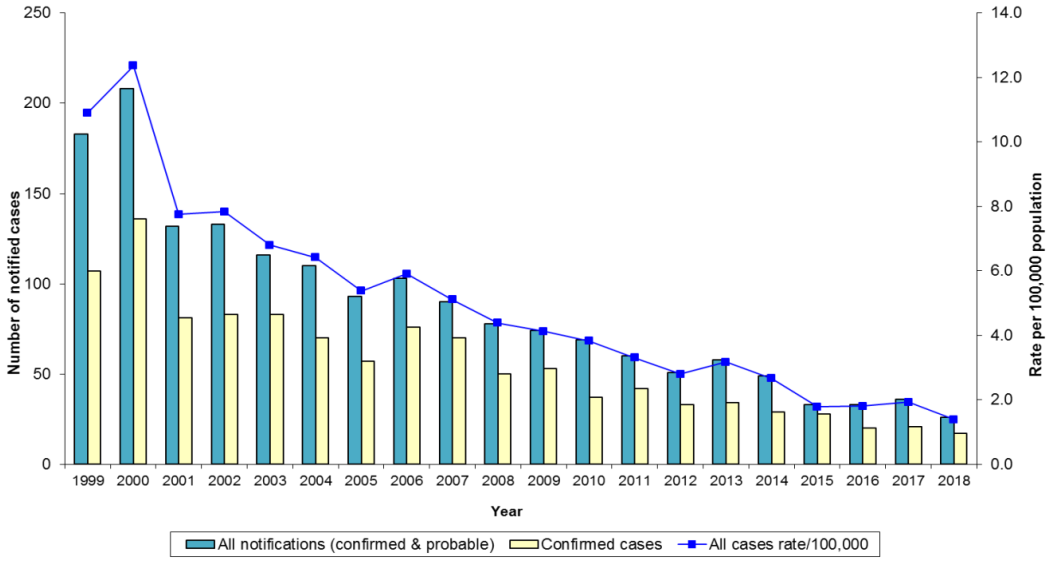
Meningococcal Disease

Meningococcal disease is caused by the bacterium *Neisseria meningitidis* (meningococcus) and is a normal inhabitant of the human nasopharynx. It is transmitted from person to person by aerosol, droplet and direct spread. Up to 10% of adults are colonised at any time and develop no signs or symptoms of disease. There are five main meningococcal serotypes, A, B, C, W, and Y that can cause disease in humans. Meningococcus can cause invasive disease, including meningitis, septicaemia and pneumonia. Young children and teenagers are at highest risk of meningococcal disease. Meningococcal serotype vaccination programmes have changed the incidence of disease over time.

Epidemiological situation

There were 26 notifications of clinically suspected invasive meningococcal disease; notification rate of 1.4 per 100,000 population. Seventeen (65%) were laboratory confirmed cases, crude incidence rate 0.9 per 100,000 population observed. Between 1999 and 2018, the number of notifications and laboratory confirmed cases has fallen with the notification rate falling by 87% from 10.9 per 100,000 to 1.4 per 100,000 population (Figure 1).

Figure 1. Number of notified and confirmed cases of IMD and overall rates per 100,000 population, 1999-2018, Northern Ireland

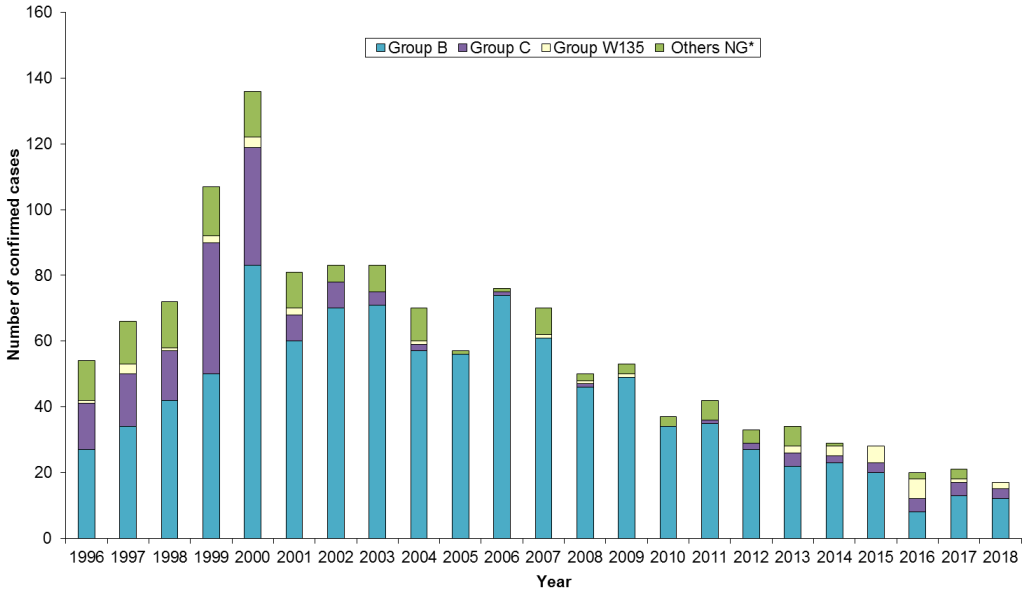


Source: Enhanced Surveillance of Meningococcal Disease (ESMD) in Northern Ireland

Serotypes

Of cases confirmed by either the Regional Virus Laboratory (RVL) or Manchester Reference Unit (MRU), serogroup B remains the most common serotype as in previous years, accounting for 71% (12) of confirmed cases. Remaining cases were seen in serogroup C, W135 and Y (Figure 2).

Figure 2. Laboratory confirmed cases of IMD by serogroup, 1996-2018, Northern Ireland



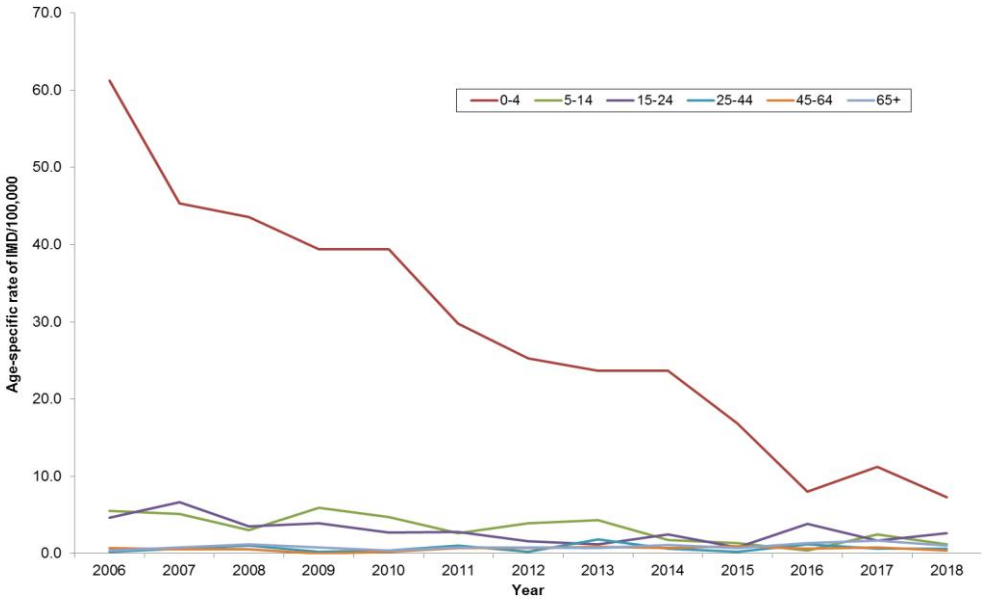
Source: Enhanced Surveillance of Meningococcal Disease (ESMD) in Northern Ireland

*Others NG refer to cases that are not groupable for various reasons

Age

The median age of confirmed cases was 16 years (range under 1 month to 84 years). Consistent with previous years, age-specific incidence was highest in infants and young children 4 years of age and under (7.3 per 100,000). The incidence rate in this age group is over eight times lower in 2018 compared to 2006 (61.2/100,000), showing a dramatic decrease between 2006 and 2016, and a less dramatic fall in the last two years, which may reflect fluctuations from small numbers (Figure 3).

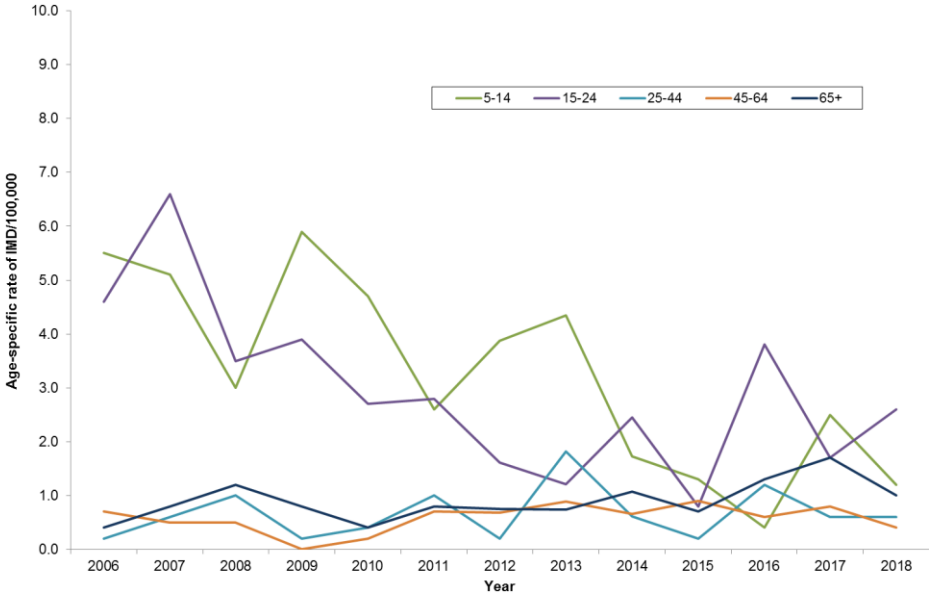
Figure 3. Age-specific incidence rates of IMD per 100,000 population, 2006-2018, Northern Ireland



Source: Enhanced Surveillance of Meningococcal Disease (ESMD) in Northern Ireland

The incidence rate for age groups over 5 years is lower than those under 5 years and have also further decreased in younger age groups (under 24 years). There is a suggestion of a small increase in those over 65 years of age (Figure 4).

Figure 4. Age-specific incidence rates of IMD per 100,000 population, with age group 0-4 years removed, 2006-2018, Northern Ireland



Source: Enhanced Surveillance of Meningococcal Disease (ESMD) in Northern Ireland

The case fatality rate of confirmed cases where meningococcal disease may have been a contributory factor decreased in 2018 (6%) compared to 2017 (14%).

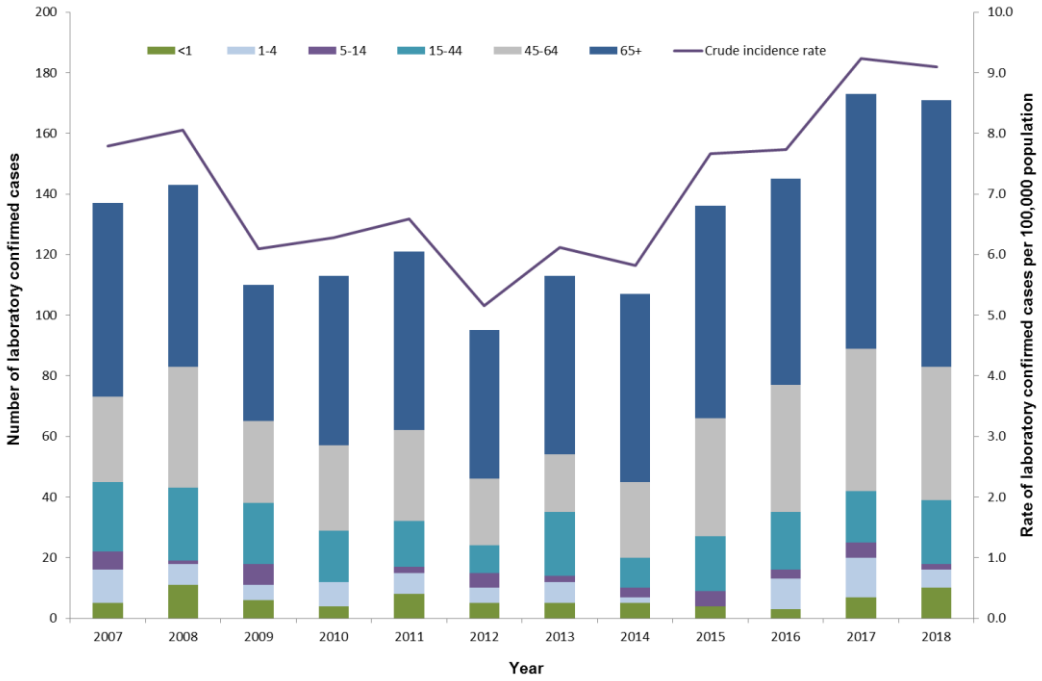
Pneumococcal Disease

Pneumococcal disease is caused by the gram-positive bacterium *Streptococcus pneumoniae* (pneumococcus). It occurs throughout the world and is a major cause of morbidity and mortality globally. There are more than 90 different pneumococcal serotypes that can cause disease in humans. It is transmitted from person to person via droplet or aerosol spread. Humans are the only reservoir for infection and carriage of the bacteria in nasopharynx is a prerequisite for disease. Disease ranges from milder non-invasive infections, such as otitis media, sinusitis and bronchitis to severe Invasive Pneumococcal Disease (IPD) such as meningitis, septicaemia, pneumonia, empyema, arthritis and peritonitis. It particularly affects very young children, the elderly and people with impaired immunity. Pneumococcal vaccination programmes have reduced the incidence of disease from vaccine-preventable strains. Recommendations for the pneumococcal vaccination have undergone a number of changes over the years.

Epidemiological situation

There were 171 laboratory confirmed cases of IPD; crude incidence rate 9.1 per 100,000 population. This is largely unchanged to the number of cases reported in 2017 (173) (Figure 5). Since 2012, there has been an upward trend in both number of cases and crude incidence rate.

Figure 5. Laboratory confirmed cases of Invasive Streptococcus Pneumoniae by age group, 2007-2018, Northern Ireland



Source: Regional CoSurv Laboratory System

Age

As with previous years, cases predominantly affect the older age groups with 77% (132) over 45 years of age. Of the older age groups, 17% (23/132) were over 85 years of age (Figure 5).

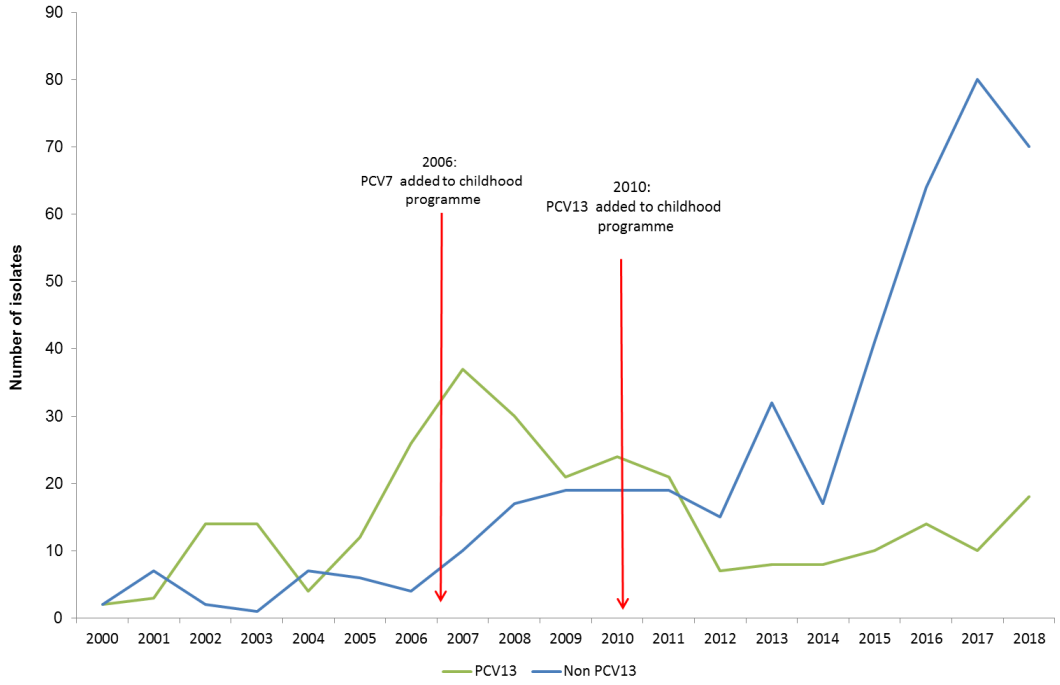
Serotypes

Typing information was available for 52% (88) of cases. Of these cases, the most common serotypes reported were 8 (20%), 12F (7%) and 3 (9%) which is consistent with the picture seen across the United Kingdom. The majority 70 (80%) of cases were caused by vaccine-preventable strains not contained in the pneumococcal conjugate vaccine 13 (PCV13) offered routinely at 2, 4 and 12 months of age. Of the 18 (20%) PCV13 type cases, the majority were over 65 years of age.

Since pneumococcal conjugate vaccine was introduced into the routine childhood programme (PCV7 in 2006 and PCV13 in 2010), the number of cases from PCV13 serotypes has declined from a peak of 37 cases in 2007 to a low of 7 in 2012 and overall remains low. However, since 2012, there has been a slight upward trend,

with 18 cases in 2018 compared to 10 in 2017. As numbers overall are small, the significance of this increase has to be interpreted with caution and will continue to be monitored. In contrast, since 2012 the number of cases from non-PCV13 strains has increased annually although a reduction has been observed in 2018 (70). Whilst this is reassuring, the pattern across the UK is of increasing numbers of non-PCV13 strains and we will continue to monitor this alongside national surveillance systems (Figure 6).

Figure 6. Laboratory confirmed cases of IPD by PCV/non-PCV serogroup, 2000-2018, Northern Ireland



Source: Regional CoSurv Laboratory System

Enhanced Surveillance in children under 5 years

The number of cases in children under 5 years of age is low, accounting for only 9% (16/171) of all reported cases of IPD in 2018 and largely unchanged from 2017 (12%). Where typing information was available none were caused by PCV13 strains.

Where vaccination information was available, the majority had received the appropriate number of doses of PCV13 vaccine for their age.

Haemophilus Influenzae

Haemophilus influenzae (Hi) is a gram-negative bacterium carried asymptomatically in the nasopharynx. There are two major categories: encapsulated and non-encapsulated. Encapsulated strains are classified by their capsular antigens where there are six recognised serotypes: a, b, c, d, e, f. The non-capsulated bacterium are non-typeable because of the absence of a capsule and are defined as 'non-capsulated' Hi. Acquisition most commonly results from asymptomatic carriers. Individuals may transfer the organism to close contacts through airborne or droplet spread by coughing and sneezing.

Before the introduction of the vaccination, the most prevalent strain was HiB. Disease caused by HiB can cause severe life-threatening disease in healthy individuals and is a major global cause of childhood meningitis, pneumonia, epiglottitis, septicaemia, cellulitis, osteomyelitis and septic arthritis. Non-capsulated Hi strains rarely cause disease outside the respiratory tract, ranging from non-invasive diseases such as otitis media, conjunctivitis, sinusitis, to pneumonia with systemic upset.

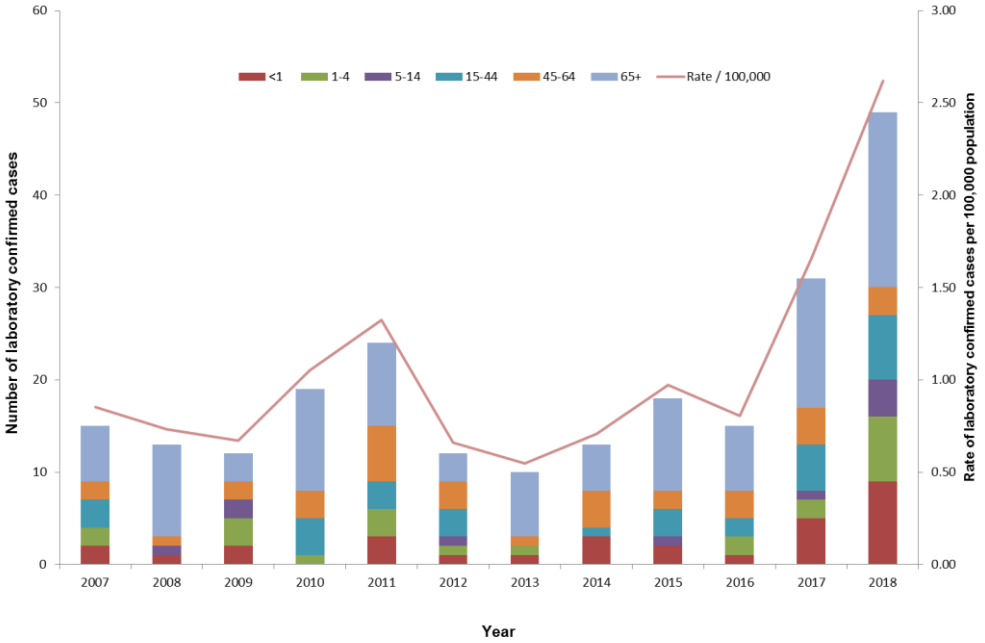
Epidemiological situation

There were 49 laboratory confirmed cases of invasive Hi disease; crude incidence rate 2.6 per 100,000 population. Between 2007 and 2016, there has been no discernible trend but a three fold increase between 2016 (15) and 2018 (49) (Figure 7).

Age

The largest proportion of cases were those over 15 years of age (59%) with the majority of these over 65 years of age (39%). Since 2016, the number of cases have increased across all age groups and is likely to be as a result of increased case ascertainment from use of culture and PCR testing (Figure 7).

Figure 7. Invasive Haemophilus Influenzae cases by age band, 2007-2018, Northern Ireland

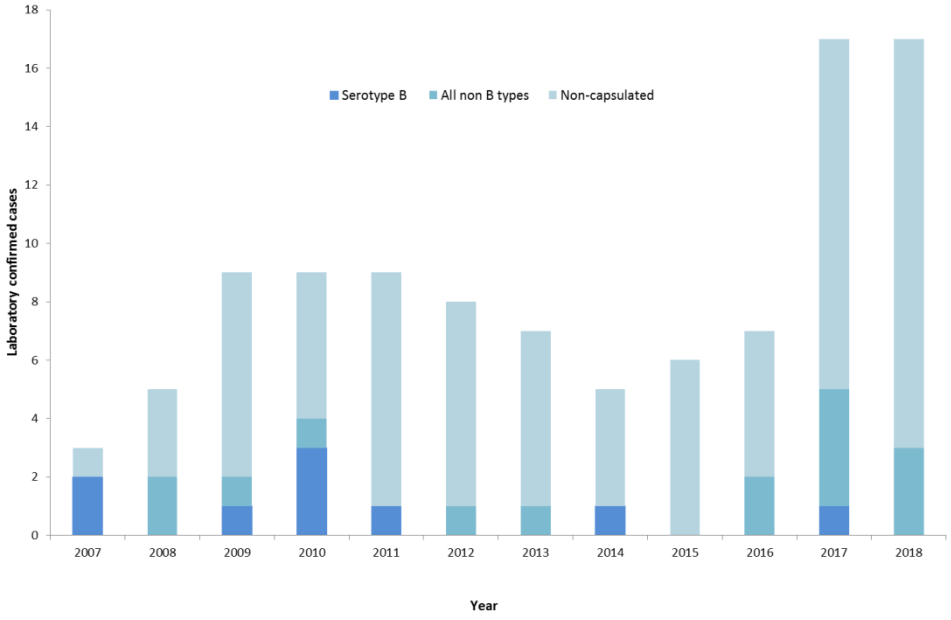


Source: Regional CoSurv Laboratory System

Serotypes

Typing information was available for only 35% of cases and of these, the majority (29%) were 'non-capsulated' Hi strains (Figure 8). Since 2007, the number of cases of HiB has remained constantly low highlighting the success of the Hib vaccine.

Figure 8. Invasive Haemophilus Influenzae cases by serotype, 2007-2018, Northern Ireland



Source: Regional CoSurv Laboratory System

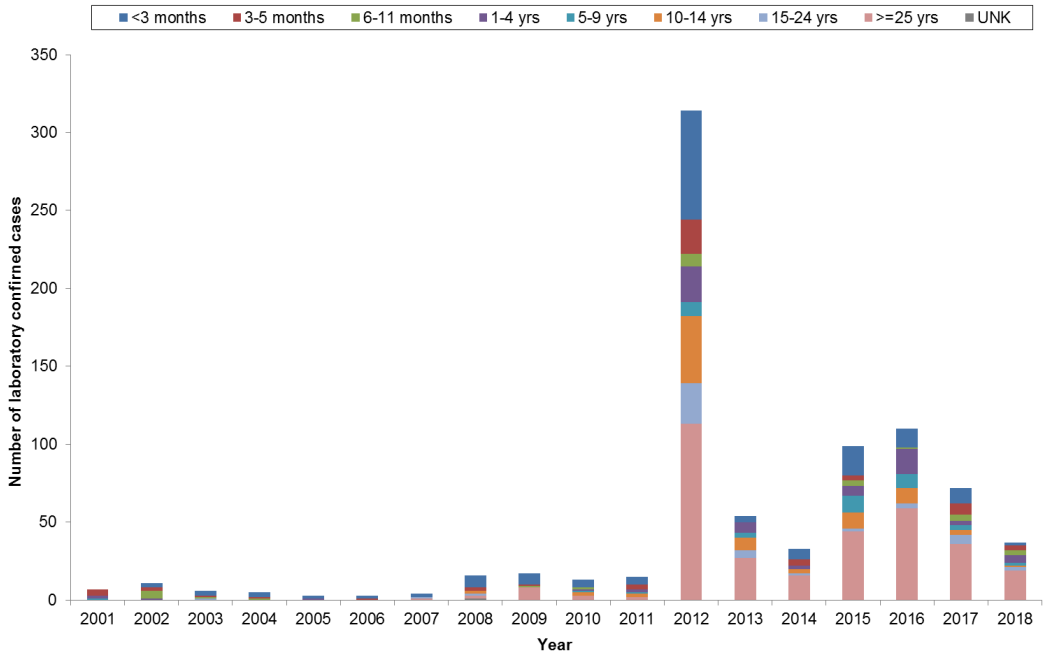
Pertussis (whooping cough)

Pertussis (whooping cough) is caused by the *Bordetella pertussis* bacterium. It is an acute respiratory disease that can cause serious and life-threatening complications, including pneumonia, apnoea and seizures. Severe complications and deaths occur mostly in infants under 6 months of age. Adolescents and adults usually suffer a milder disease with a cough that may persist for many weeks.

Epidemiological situation

There were 37 laboratory confirmed cases which is a 49% decrease from 2017 (72) and consistent with the 3 year cyclical pattern seen with pertussis infection. Since 2012, when cases peaked (314) and a national outbreak was declared, the mean number of cases (68; range 33-110) has remained higher than the pre-outbreak baseline (9; range 3-17) (Figure 9).

Figure 9. Laboratory confirmed cases of Pertussis by age group, 2001-2018, Northern Ireland



Source: Regional CoSurv Laboratory System/Pertussis Enhanced Surveillance System

Age

The greatest number of cases was in those aged over 25 years (51%; 19/37), followed by <6 months of age (14%; 5/37), (followed by the 1-4 years (14%; 5/37), with 6-11 months, 5-9 years, 10-14 years and 15-24 years accounting for 8 cases in total (22%; 8/37).

Measles

Measles disease is caused by a morbillivirus of the paramyxovirus family. It can affect people of all ages but infants less than one year are at increased risk of complications and death. It typically causes fever, malaise, conjunctivitis, cough, coryza and Koplik spots followed by a widespread maculopapular rash. Complications occur in around 1 in 15 notified cases and include otitis media, pneumonia, convulsions, encephalitis and death. A rare complication of measles is subacute sclerosing panencephalitis (SSPE), a fatal degenerative neurological disorder. The case fatality ratio is approximately one death per 5,000 cases, highest in children under one year.

The measles virus is transmitted from person to person by respiratory droplet. It is very infectious, with one case having the potential to infect another 12-18 individuals in susceptible populations. Measles cases are infectious in the four to five days before rash onset and the four days after.

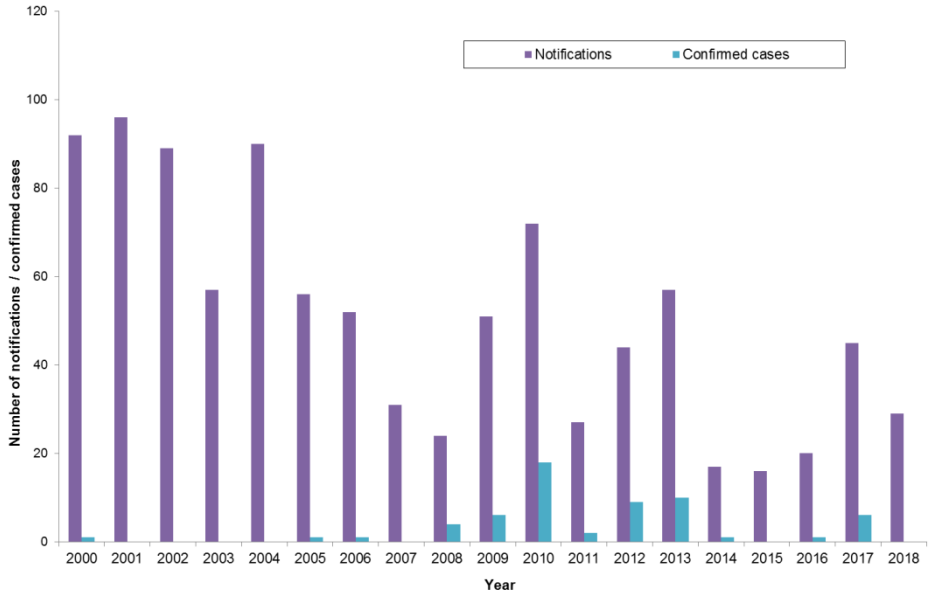
Throughout 2018, European Union (EU) Member States reported 12,352 cases of measles, with the highest number of cases reported in France (2,913), Italy (2,517), Greece (2,293), Romania (1,087), United Kingdom (953), Slovakia (572) and Germany (542). It is noted that delays in reporting have likely led to an underestimate of cases, particularly in Romania, where there has been a sustained outbreak within the country[7].

Epidemiological situation

There were 29 notifications of clinically suspected measles all of which had PCR and/or serology testing and were discarded as cases. There were therefore no confirmed cases with the last confirmed cases during the summer of 2017.

The number of notifications have decreased compared to 2017 (45) on a background of an overall downward trend in notifications since 2000 (10).

Figure 10. Notifications and laboratory confirmed cases of Measles, 2000-2018, Northern Ireland



Source: Measles Enhanced Surveillance System and HPZone

Age

Suspected measles cases were observed in both adults and children with 62% of cases in children aged under 4 years. The median age was 2 years, ranging from 2 months to 45 years. The age distribution of suspected measles has been variable for the past four years. The majority were unvaccinated children and young adults.

Mumps

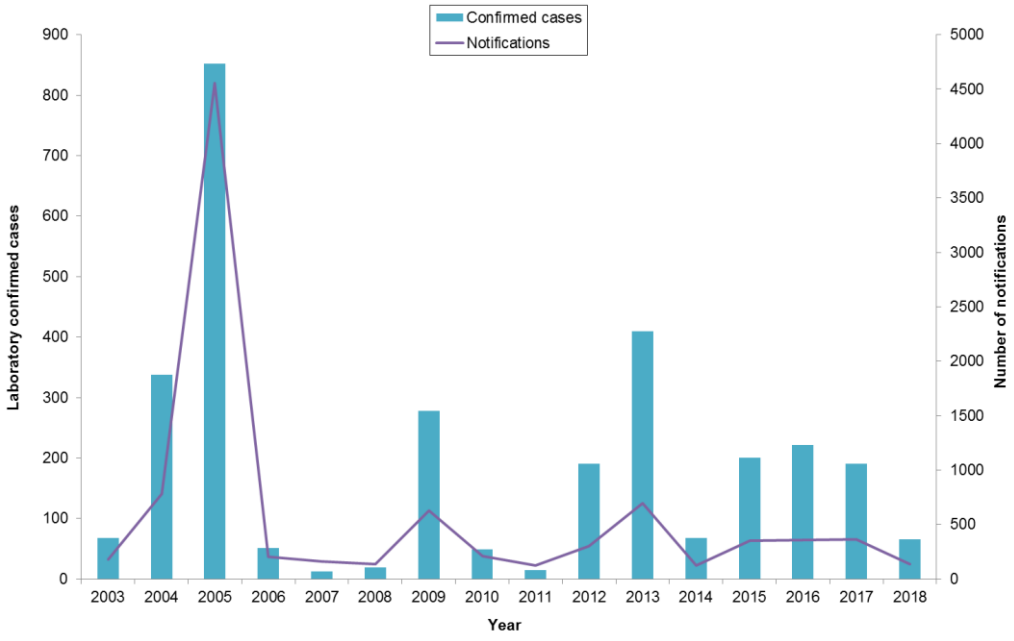
Mumps disease is caused by the mumps virus. The disease is characterised by parotitis, fever, headache and lymphadenopathy. Infection can lead to serious complications, including aseptic meningitis, encephalitis, orchitis, pancreatitis,

oophoritis and permanent deafness. Neurological involvement can also occur. Orchitis is the most common complication of mumps in adult males. Person to person transmission occurs by respiratory droplets with cases infectious from around 6-7 days before the onset of parotitis until 9 days after. However, infected individuals with no apparent clinical symptoms can also transmit the virus.

Epidemiological situation

There were 66 laboratory confirmed cases of mumps, which is a 65% decrease compared to 2017 (191). A sharp rise in confirmed cases was observed in 2004, with the number of cases peaking at 850 in 2005. Since then there has been fluctuation in the number of confirmed cases that follows the cyclical epidemiological pattern of mumps virus (Figure 10).

Figure 10. Notifications and laboratory confirmed cases of Mumps, 2003-2018, Northern Ireland

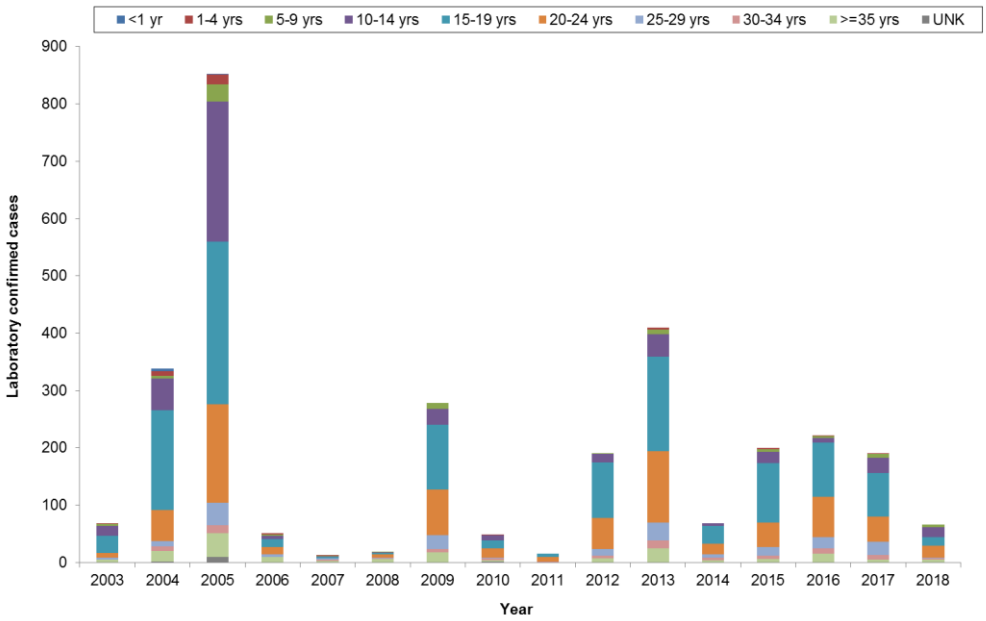


Source: Mumps Enhanced Surveillance System and HPZone
NB: Two different scales used

Age

The majority of cases were aged 15-24 years (53%; 35/66) (Figure 11). The majority of cases (79%) had received two doses of MMR vaccine. This may represent waning immunity within the fully and/or partially vaccinated population.

Figure 11. Laboratory confirmed cases of Mumps, by age group, 2003-2018, Northern Ireland



Source: Mumps Enhanced Surveillance System and HPZone
Note: salivary antibody testing for mumps ceased in May 2010

Rubella (German Measles)

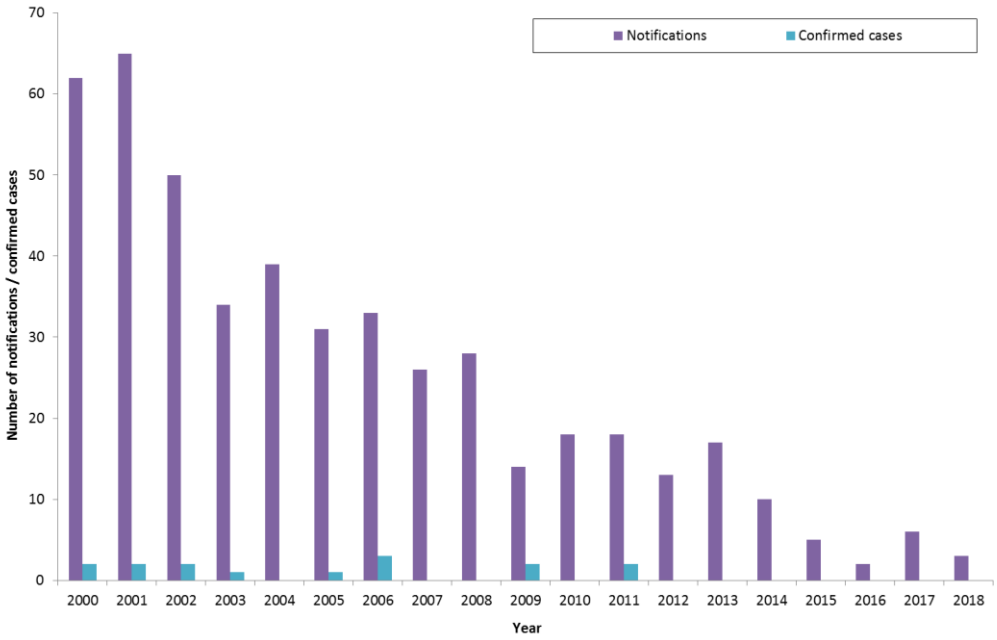
Rubella is an acute infection caused by rubella virus. It is generally a mild illness, but can have devastating affects if acquired by women in the first 16 weeks of pregnancy, leading to congenital rubella syndrome in the unborn baby. The infection may begin with a prodromal illness. Occipital and post-auricular lymphadenopathy may also occur before onset of an erythematous rash. Complications include thrombocytopenia, arthritis and arthralgia in adults, especially women, and encephalitis.

The disease is spread by droplet transmission from person to person. Cases are considered infectious from one week before the start of symptoms and are most infectious in one to five days after the onset of the rash.

Epidemiological situation

There were less than 5 clinically suspected notifications of rubella, all discarded on PCR and/or serology testing and therefore no laboratory confirmed cases. Since 2012, there have been no laboratory confirmed cases of rubella and the number of notifications has been declining over time (Figure 12).

Figure 12. Notifications and laboratory confirmed cases of Rubella, 2000-2018, Northern Ireland



Source: Rubella Enhanced Surveillance System and HPZone

Diphtheria

Diphtheria is an infection caused by diphtheria toxin produced by gram-positive toxigenic bacterium *Corynebacterium diptheriae*. It occurs throughout the world and is a major cause of morbidity and mortality globally. Incidence has fallen dramatically since introduction of diphtheria vaccine into the childhood programme. However, it continues to cause high mortality in some parts of the world associated with

outbreaks. It is an acute disease that affects the upper respiratory tract and occasionally the skin. The infection is transmitted from person to person via droplet or aerosol spread with humans the only reservoir for infection.

Epidemiological situation

No clinically suspected notifications or laboratory confirmed cases reported in 2018. Following the introduction of vaccine into the routine childhood programme, the incidence of disease has fallen dramatically with no cases in Northern Ireland in recent times.

Tetanus

Tetanus is a rare disease caused by a neurotoxin produced during infection with *Clostridium tetani*. The disease is characterised by rigidity and spasm of muscles, with the jaw usually affected (lockjaw) before becoming more generalised. The case-fatality ratio can range from 10%-90% with it being higher in the young and elderly.

C. tetani are common environmental bacteria and can form spores which are highly resistant to heat and freezing. They are present in soil and manure and commonly enter the body through a wound, burn, puncture or scratch. Tetanus cannot be transmitted from person to person.

Epidemiological situation

No clinically suspected notifications or laboratory confirmed cases reported. Since introduction of vaccination, the incidence of disease has fallen dramatically with no cases in Northern Ireland in recent times.

Poliomyelitis (Polio)

Poliomyelitis is an acute illness caused by the poliovirus. There are three serotypes of the virus: 1, 2, 3. Transmission occurs through contact with the faeces or pharyngeal secretions of infected individuals who can excrete virus for up to 6 weeks in faeces and two weeks in saliva. The virus infects and replicates in the gastrointestinal tract before spreading through the body to susceptible tissues or

rarely the central nervous system. The majority of infections cause no clinical symptoms but there is a range of symptoms, from fever to aseptic meningitis or paralysis. Gastrointestinal symptoms, malaise, stiffness of the neck and back and headache can also occur, with or without paralysis.

Epidemiological situation

Since introduction of vaccine, the incidence of disease has fallen dramatically with no cases in Northern Ireland in recent times.

Conclusions

Overall, the burden of disease from vaccine-preventable infections is low in Northern Ireland and in 2018, cases across VPDs have fallen further with the exception of Haemophilius influenzae and Pneumococcal disease. This is undoubtedly due to the success of regional vaccination programmes that continue to experience high levels of uptake across the region. The increase in Haemophilius influenzae and Pneumococcal disease cases highlight the importance of monitoring the epidemiology of VPDs to identify changes following introduction of vaccine programmes particularly with high vaccine coverage.

Although there have been no confirmed measles cases observed locally during 2018, the small outbreak of measles from an imported case in 2017 and continued outbreaks during 2018 in the UK and Europe serve as a reminder that the risk of imported cases remains and the importance of maintaining high vaccine uptake.

During 2018 the PHA Immunisation Team commissioned a professional marketing company to carry out focus groups with a harder to reach community group to better understand attitudes and factors influencing vaccinations. Findings showed a general acceptance of vaccinations but highlighted communication issues and access as barriers to receiving vaccines. The PHA has developed a promotional video resource with limited text and language to promote MMR vaccine across the population and in harder to reach groups where literacy and language may act as barriers to knowledge and during 2019 plan to disseminate widely[8].

For the next year the PHA Immunisation Team also plan to review the enhanced surveillance systems for vaccine-preventable bacterial infections to ensure the clinical, microbiological and serotying information is continuing to meet the needs of the population.

Priorities for 2019

1. The PHA Immunisation Team plans to review the vaccine-preventable bacterial infections enhanced surveillance systems.

2. The PHA will continue to monitor vaccine coverage and target interventions to improve uptake, such as use of the PHA MMR promotional video amongst groups in which vaccination uptake is known to be low.

Sources of Further Information

The most useful resource for health professionals is the on-line version of The Green Book, which contains the most up-to-date information on immunisation.

Name	Link
Immunisation against Infectious Diseases ("The Green Book")	https://www.gov.uk/government/collections/immunisation-against-infectious-disease-the-green-book
Public Health Agency Immunisation page	http://pha.site/immunisationvaccine-preventable-diseases
Public Health England Immunisation page	https://www.gov.uk/government/collections/immunisation
Chief Medical Officer (CMO) letters (Northern Ireland)	https://www.health-ni.gov.uk/publications/letters-and-urgent-communications-2019
Country Specific Vaccine schedules	http://apps.who.int/immunization_monitoring/globalsummary/schedules
Vaccination of individuals with uncertain or incomplete immunisation status	https://www.gov.uk/government/publications/vaccination-of-individuals-with-uncertain-or-incomplete-immunisation-status
Public Health Agency Publications	http://www.publichealth.hscni.net/publications

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HSC Public Health Agency

item 12

Title of Meeting	PHA Board Meeting
Date	18 April 2019
Title of paper	Point Prevalence Survey of Healthcare Associated Infection and Antimicrobial Use in Northern Ireland Acute Hospitals
Reference	PHA/06/04/19
Prepared by	Mark McConaghy and Dr Tony Crockford
Lead Director	Dr Adrian Mairs
Recommendation	For **Approval** ☐ For **Noting** ☒

1 Purpose

This report provides the results of the 2017 Point Prevalence Survey (PPS) of healthcare associated Infections (HAI) and antimicrobial use (AMU) in Northern Ireland. The survey helps to determine the overall burden of HAI and AMU in our acute hospitals and also helps to inform the priority areas for future working.

The report is being brought to the PHA Board for noting prior to publication in the public domain.

2 Background Information

Under PHA's Corporate Plan Objective 4, "All health and wellbeing services should be safe and high quality", there is a target in the 2018/19 Business Plan that PHA will "improve patient safety and experience by bringing leadership to reducing healthcare-associated infections". This report forms part of that work.

3 Key Issues

The key points from this survey include:

- PPS 2017 included 3,813 in-patients across all 16 acute hospitals in Northern Ireland. As in the last survey this is a 100% snapshot of in-patients on a specific day, so results are both robust and reliable.

Prevalence of Antimicrobial Use

- The current Antimicrobial consumption in acute hospitals was 36.3%. This finding is similar to the rates recently published in other parts of the UK, but is a larger proportion than was found in 2012 when it was 29.5%.
- The most common reason for antibiotic treatment was for a community acquired infection (60.6%) followed by a hospital-acquired infection - 21.5%.
- A total of 1,294 antimicrobials (62.4%) were delivered intravenously. Overall, 5.3% and 8.9% of antimicrobials prescribed were for prevention of infection following surgical and medical treatment.

Prevalence of Health Care Associated infections

- The results indicate that the prevalence of HAI (i.e. number of patients with a healthcare associated infection present in an acute hospital at a given point in time) was 6.1%. This figure is higher than the corresponding figure in 2012. The rate in Northern Ireland is similar to the rate reported in other parts of the UK, which contrasts with 2012 when it was lower.
- The most common types of HAI identified in PPS 2017 were respiratory (29%), surgical site (17%) and gastrointestinal (10%).
- Overall the rate for respiratory infections was greater than in the last survey, and there were a greater number of surgical site infections and bloodstream infections. In contrast the infection rate for hospital associated UTI has decreased, and was lower than that observed in other parts of the UK.
- The report identified key priority areas for the IPC and Antimicrobial Stewardship Programmes both at local and regional levels. Trust level reports/results have already been shared with trust relevant teams.

4 Next Steps

Following this meeting the Report will be published on the PHA website.

Each Trust has been asked to prepare a short report/update for their SMT and Trust Board advising of the main findings for their hospital(s) and Trust including action required to address key priority areas at local level.

At regional level, priorities for action are incorporated into the current work programme for the Regional HCAI & AMR Improvement Board

Final draft cover

Acknowledgements

We wish to acknowledge and express our thanks to members of infection prevention and control and antimicrobial stewardship teams in all acute hospitals in Northern Ireland who completed the fieldwork for the Point Prevalence Survey (PPS) across their respective organisations.

We especially acknowledge and thank the members of the PPS Delivery group for their invaluable input and guidance as the survey progressed. We would like to thank: Gerry McIlvenny, Caroline McGeary, Fiona Hughes, Alison Griffiths, Fiona Morris and Eamon Nancarrow for their input in training and preparation and for undertaking data collection in the validation study. In addition, we are grateful to Dr Dylan MacLochlainn who provided additional support to the training and validation teams. We are very grateful to Eileen Morelli and Tracey Bone for their administrative support.

We are greatly appreciative to the support provided by Carl Suetens and staff at the European Centre for Disease Prevention and Control (ECDC), Stockholm.

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Contributors – Declan Bradley, Tim Wyatt

Reference this report as:-

Northern Ireland Point Prevalence Survey of Hospital Associated infections and Antimicrobial Use, 2017. Public Health Agency. August 2018

Published by:

Public Health Agency, Northern Ireland

12-22 Linenhall Street, Belfast

Northern Ireland BT2 8BS

Contents

Tables

Figures

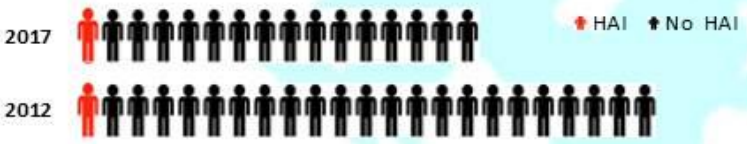
Glossary

AM	Antimicrobial
AMU	Antimicrobial use
AMR	Antimicrobial resistance
BSI	Bloodstream infection
CAUTI	Catheter-associated urinary tract infection
CDC	Centers for Disease Control and Prevention
CDI	*Clostridium difficile* Infection
CI	Confidence interval
CNS	Central nervous system
CVC	Central vascular catheter
CVS	Cardiovascular system
DoH	Department of Health
DHSSPS	Department of Health, Social Services and Public Safety
ECDC	European Centre for Disease Prevention and Control
ENT	Ear, nose, throat
ESAC	European Surveillance of Antimicrobial Consumption
ESBL	Extended spectrum beta-lactamase
GI	Gastrointestinal infection
HELICS	Hospitals in Europe Link for Infection Control through Surveillance
HAI	Hospital associated infection
HIS	Healthcare Infection Society
HSCB	Health and Social Care Board
HPSC	Health Protection Surveillance Centre
IPCN	Infection prevention and control nurse
ICU	Intensive care unit
IPSE	Improving Patient Safety in Europe
KISS	Krankenhaus Infektions Surveillance System (German)
LRTI	Lower respiratory tract infection other than pneumonia
MRSA	Meticillin resistant *Staphylococcus aureus*
MSSA	Meticillin sensitive *Staphylococcus aureus*
NHSN	National Healthcare Safety Network
NNIS	National Nosocomial Infection Surveillance
PHA	Public Health Agency
PPS	Point Prevalence Survey
PVC	Peripheral vascular catheter
SSI	Surgical site infection
UC	Urinary catheter
UTI	Urinary tract infection
VAP	Ventilator-associated pneumonia

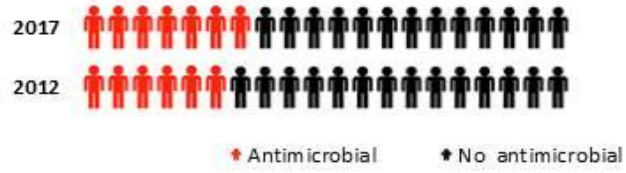
Executive Summary

The composition of inpatients was older, 55.5% over 65 years compared with 50.9% in 2012. In addition, a larger group of patients was classified as seriously ill in 2017 (5.4% v 2.9%)

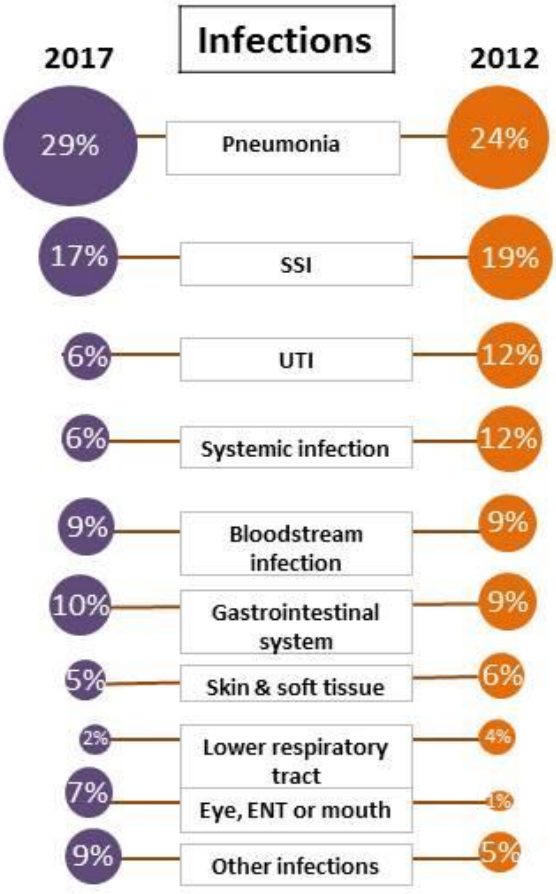
A larger proportion of patients had an infection. Approximately 1 in 16 acute inpatients had a healthcare acquired infection. The comparable figure in 2012 was 1 in 23 inpatients

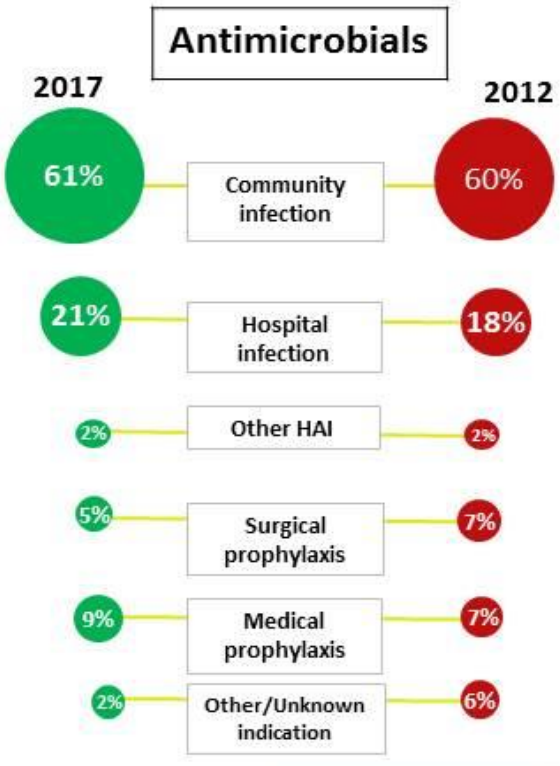


A larger proportion of patients were receiving antimicrobials. Approximately 6 in 20 acute inpatients received one or more antimicrobials in 2012, the comparable proportion rose to 7 in 20 in 2017



The distribution of HAI showed that the most common HAI were: pneumonia (29%), surgical site infection (17%) and gastrointestinal infection (10.4%). There was a notable decline in the proportion of urinary tract infections





The proportion of medical devices in use between 2012 and 2017 was similar for central vascular catheters (1 in 20), intubation (1 in 50) and urinary catheter (1 in 6) but was higher for peripheral vascular catheter, 52.8%

As in 2012 all sixteen acute hospitals participated in the PPS survey in 2017. The most common healthcare associated infections were: pneumonia (29%), surgical site infection (17%), gastrointestinal infection (10.4%), bloodstream infection (8.7%), urinary tract infection (6.2%) and systemic infection (6.2%).

The proportion of paediatric patients included in the survey was 8.5%, which was similar to 2012, although there was a fall in those aged between 1 and 23 months. The proportion of neonates was similar at 4.4%. The number of HAI reported in neonates was greater, at 8.3%, compared to the previous study when it was 1.6%.

The highest prevalence of antimicrobial prescribing was in adult ICU, where 64.9% of patients received antimicrobials, an increase of almost ten percentage points since 2012. This was followed by mixed specialty wards and medical wards, where 50.8% and 40.6% of patients respectively received antimicrobials.

Gram-positive cocci accounted for 37.3% of all microorganisms, with the largest proportion being *Staphylococcus aureus* 18.6% and *Enterococcus spp* 9.8%. Gram-negative Enterobacteriaceae accounted for 35.3% - the largest proportion being *Escherichia coli* 20.6%.

Overall, 11.7% of prescribed antimicrobials were not compliant with local guidelines and significant proportions were prescribed off guideline including; co-amoxiclav (28.4%), meropenem (10.7%), and piperacillin/tazobactam (15.5%). The majority of antimicrobials were delivered parenterally (63%).

The majority of hospitals reported having an active review of antimicrobial prescribed after 72 hours, but this was restricted to patients in ICU and other selected wards.

ANTIBIOTIC GUARDIAN

The most common reason for antimicrobial prescribing was for infections considered to be community acquired. There were 861 patients treated for community acquired infection or 22.6% of the hospital population. Treatment of community acquired infection accounted for 60.6% of all prescribed antimicrobials. Surgical prophylaxis and medical prophylaxis accounted for 5.3% and 8.9% of all antimicrobials respectively.

Key results

Prevalence of HAI

The 2017 point prevalence survey of hospital associated infections and antimicrobial consumption in Northern Ireland included all sixteen acute hospitals and 3,813 patients. The overall HAI prevalence was 6.1% (95%CI 5.4 – 6.9).

Comparable rates of hospital associated infections in Europe and UK		
Country	**HAI prevalence 2011/12**	**HAI prevalence 2016/17**
Europe – ECDC PPS	6.0 (5.9 – 6.1)	To be published
England (Acute) (1)	6.5 (4.8 – 8.8)	To be published
Scotland (Acute) (2) (3)	4.9 (4.4 – 5.4)	4.5 (4.0 – 5.0)
Wales (Acute) (4) (5)	4.3 (3.8 – 4.8)	5.5 (5.0 – 6.1)
Northern Ireland (6)	4.2 (3.6 – 4.8)	6.1 (5.4 – 6.9)

The most commonly identified HAIs were pneumonia (29% of all HAI), followed by surgical site infection (17%), gastrointestinal infection (10.4%), bloodstream infections (8.7%), urinary tract infection (6.2%) and systemic infection (6.2%).

Overall the prevalence of urinary catheter and central vascular catheter use has not changed since 2012. However, when similar survey populations were compared, the use of peripheral vascular catheters was significantly higher in 2017 than in either 2006 or 2012.

Gram-positive cocci accounted for 37.3% of all microorganisms, with the largest proportion being *Staphylococcus aureus* 18.6% and *Enterococcus spp* 9.8%. Gram-negative Enterobacteriaceae accounted for 35.3% - the largest proportion being *Escherichia coli* 20.6%.

As in the 2012 PPS, the proportion of MRSA identified in 2017 was very low (< 0.1%) maintaining the decrease from the PPS in 2006. *Clostridium difficile* accounted for 16.7% of all microorganisms reported. When similar survey populations were compared, *Clostridium difficile* prevalence remained around 0.3% of the patient population surveyed, similar to 2012 and lower than 1% identified in 2006.

Prevalence of antimicrobial use

The overall prevalence of antimicrobial use was 36.3% (95%CI 34.8 – 37.9). The highest antimicrobial use (64.9%) was reported in adult intensive care units (ICUs) followed by mixed specialty (50.8%) and medical specialty (40.6%) wards. The prevalence of antimicrobial use in paediatrics was (31.3%).

The most common indication for antimicrobial prescribing was for community acquired infections - 22.6% (95%CI; 21.3-23.9) of all patients; 60.6% of all prescribed antimicrobials. Overall 8.1% (95%CI; 7.2-9.0) patients were prescribed antimicrobials specifically for hospital associated infection. Prophylaxis accounted for 14.2% of all antimicrobials (5.3% surgical prophylaxis, 8.9% medical prophylaxis).

Overall, 11.7% of prescribed antimicrobials were not compliant with local guidelines, and significant proportions were prescribed off guideline including co-amoxiclav (28.4%), meropenem (10.7%), and piperacillin/tazobactam (15.5%).

The majority of antimicrobials were delivered parenterally (63%), and there was limited evidence of adoption of a formal 72 hour review of antimicrobial treatment.

Comparable rates of antimicrobial use in Europe and UK		
Country	**AMU prevalence 2011/12**	**AMU prevalence 2016/17**
Europe – ECDC PPS	35.0 (34.8 – 35.2)	To be published
England (Acute) (1)	34.3 (30.1 – 39.2)	To be published
Scotland (Acute) (2) (3)	32.3 (30.9 – 33.8)	35.3 (33.8 – 36.7)
Wales (Acute) (4) (5)	32.7 (31.6 – 33.9)	34.2 (33.0 – 35.3)
Northern Ireland (6)	29.5 (28.1 – 30.9)	36.3 (34.8 – 37.9)

Priorities

Summary of HAI priorities

1. Explore feasibility for scoping and implementing a project aimed at reducing the burden of non-ventilator associated pneumonia.
2. Continued emphasis on education and training of clinical staff on methods for improvement and prevention of HAI, with particular emphasis on learning tools for prevention of healthcare associated pneumonia and LRTI.
3. Consideration should be given to the development of methodologies to support standardised incidence surveillance of respiratory tract infections and clinical sepsis most commonly reported in the hospital context.
4. Continue to promote evidence based practice to reduce surgical site infection across surgical specialties (WHO bundle compliance, application of NICE and CDC guidelines as well as other relevant guidance).
5. Given an increased rate of surgical site infection observed in this survey, a review and validation of the case ascertainment and reporting arrangements in the current SSI surveillance programmes (caesearean section, orthopaedic, cardiac and neurosurgery) is recommended.
6. The future SSI surveillance arrangements should consider the need for improved methodology for the SSI incidence surveillance programme with a view to developing more efficient systems for data collection.
7. The requirement for potential extension of the SSI surveillance programme into other speciality/procedure areas should be taken forward in collaboration with relevant stakeholders.
8. Continue to focus on a programme to reduce overall use of urinary catheters and ensure best practice for management of catheters *in situ*.

9. Further investigation is required to examine the PPS findings related to increasing oral cavity infections, and infections in paediatrics and mixed specialty hospital wards.

Summary of Device Use priorities

1. Continue to promote awareness of the presence of invasive devices as a significant risk factor for development of HAI in the hospital setting by strengthening the implementation of high impact interventions such as care bundles. Countinued emphasis on education and training of clinical staff responsible for insertion and maintenance of invasive devices, including the regular assessment of competency of clinical staff and the use of hand hygiene/care bundles.
2. Emphasis should be on maintaining the current ICU incidence surveillance programme, validating data reported on, Ventilator Associated Pneumonia (VAP), Central Line Associated Blood Stream Infection (CLABSI) and Catheter Associated Urinary Tract Infection (CAUTI), and continue to ensure that units are recording data accurately and using it for quality improvement and benchmarking against other regions.
3. In wards where the prevalence of patients with a peripheral vascular catheter was high, a review should be considered with a view to developing interventions that ensure appropriate use and maintenance of peripheral lines including line reviews.

Summary of Microbiology priorities

1. Continued focus on the importance of developing appropriate regional and local capacity to monitor antimicrobial use and antimicrobial resistance across hospitals as well as the characteristics of patients affected and relevant risk factors. This should include capacity to monitor gram-negative infections.

Summary of Antimicrobial Use priorities

1. Continued focus on the development and importance of effective antimicrobial stewardship in the hospital, primary, and community care settings.
2. Further developments are required for accurate assessment and monitoring of antimicrobial use, and implementation of regional guidelines across all Trusts, addressing the appropriate use of broad spectrum antimicrobials e.g. meropenem and piperacillin-tazobactam.
3. A set of quality indicators relating to antimicrobial prescribing needs to be considered at a Trust and Northern Ireland level. These should include compliance with local policy, review of antimicrobial use within 72 hours, recording of indication for treatment and reason for any departure. Monitoring of these quality indicators should be facilitated through ongoing surveillance and feedback by regular reporting.
4. Regular reporting and assessment of antimicrobial consumption data for each hospital, with case-mix stratification should be implemented.
5. Sustained emphasis on ensuring appropriate antimicrobial use and on promoting early switch from parenteral to oral agents as clinically appropriate.

6. Consideration of a targeted programme aimed at reducing antimicrobial requirements and ensuring appropriate antimicrobial use for infections of the respiratory system, particularly including the diagnosis and treatment of pneumonia across the region.
7. Ongoing monitoring in relation to antimicrobials used for prophylaxis, and in particular surgical prophylaxis lasting longer than 24 hours / or more than one dose administered.
8. Sustained emphasis on antimicrobial stewardship and prescribing competencies, with particular emphasis on leadership provided through multi-disciplinary team working.

1. Introduction

Healthcare-associated infections (HAI) can develop either as a direct result of healthcare interventions such as medical or surgical treatment, or from being in contact with an acute or community healthcare setting. The term HAI covers a wide range of infections (7). The most well-known include those caused by meticillin-resistant *Staphylococcus aureus* (MRSA), meticillin-sensitive *Staphylococcus aureus* (MSSA), *Clostridium difficile* (C.diff) and *Escherichia coli* (E. coli).

More than four million people in Europe acquire a healthcare-associated infection (HAI) every year. Of these approximately 37,000 die as a direct result of the infection (8). The death toll from HCAI is comparable to the number of people who die each year in road traffic accidents. Antimicrobial use (AMU) is a key driver of antimicrobial resistance; understanding the indications, dose prescribed, and adherence to guidelines is essential to develop better stewardship of antimicrobials (9).

Surveillance of HAI and AMU is an essential component of infection prevention and antimicrobial stewardship (10). It drives key actions by planning and implementing more effective, evidence-based policies, surveillance and strategies. However, robust comparable data for HAI and AMU (other than mandatory reporting) are not currently available for the Health & Social Care (HSC) in Northern Ireland, making it difficult to quantify if there have been any changes in the rates of HAI and AMU across HSC trusts other than those reported on a mandatory basis.

Prevalence surveys are useful in providing data on the proportion of HAI and proportion and types of AMU at any one point (or period) in time in hospitals and give a better understanding of the burden of both HAI and community-acquired infection (CAI) treated with antibiotics and AMU. To reduce the burden of HAI and antimicrobial use there is a requirement for good, representative baseline and trend information. Regional point prevalence surveys (PPS) are undertaken every five years in Northern Ireland (NI) to understand the current epidemiological situation and to review local and national policy. Therefore, Northern Ireland participated in the ECDC PPS survey.

This PPS is the fifth national PPS on healthcare-associated infections and the third national combined survey on HAI and antimicrobial use in Northern Ireland. Whilst there have been certain changes to the definitions used for surveillance in the different years in which surveys have been completed, there has been greater consistency since 2012, meaning that comparisons between 2012 and 2017 have greater validity. This report compares and contrasts the 2012 and 2017 surveys so that a better insight into the pattern of infections and antimicrobial use affecting patients can be obtained. This will provide clarity on the ongoing burden of HAIs and will help to shape antimicrobial stewardship and infection control measures further to reduce HAIs in NI's hospitals. Key protocol changes are summarised in Appendix A.9

2. Background

Northern Ireland (NI) first participated in a UK point prevalence survey (PPS) of healthcare-associated infections (HAI) in acute hospitals in 1994. This was followed by another PPS in acute hospitals in 2006.

In 2008, the dedicated surveillance network for European HAI surveillance was transferred to the European Centre for Disease Prevention and Control (ECDC). ECDC undertook to develop an agreed EU protocol for a European PPS of hospital associated infection (HAI) and antimicrobial use in acute hospitals during 2011 and 2012. Northern Ireland participated in the PPS during 2012. In total, 33 administrative areas in 29 EU Member States provided data on 231,459 patients in 947 hospitals (8). The European HAI prevalence was 6% and antimicrobial use prevalence was 35%. In Northern Ireland, the HAI prevalence was 4.2% and antimicrobial use prevalence was 29.5%.

The second EU-wide PPS took place during 2016 and 2017. Northern Ireland completed the PPS data collection during June – July 2017. The PPS in Northern Ireland was coordinated by the Public Health Agency on behalf of Department of Health. The results from this PPS provide an opportunity to review the current epidemiology of HAI and antimicrobial prescribing and, for the first time, describe infection prevention and control (IPC) and antimicrobial stewardship structures and processes in Northern Ireland hospitals (refer to Section 7). Information from this survey will inform the development of key priority areas and recommendations for the prevention and control of HAI, and quality improvement interventions for IPC and antimicrobial stewardship.

2.1. Previous prevalence studies of HAI across UK and Ireland

In 2012, Northern Ireland, along with the rest of the UK and Republic of Ireland, took part in the ECDC point prevalence survey of Health-care Associated Infections.

Preceding this, Northern Ireland took part in UK prevalence surveys in 1993 and 2006.

Table 1 Northern Ireland, UK & Ireland prevalence of HAI

Prevalence survey	Patients surveyed	Number with HAI	Prevalence	95%CI
Northern Ireland 2012 (6)	3,992	166	4.2#	3.6 – 4.8
Northern Ireland 2006	3,644	198	5.4	4.7 – 6.2
UK* & Ireland 2006 (11)	75,856	5,773	7.6	7.4 – 7.8
UK 1993/94 (12)	37,111	3,353	9.0	8.8 – 9.3

* Scotland not included
# If psychiatric wards were excluded the prevalence of HAI increases to 4.3% (CI 3.7 – 5.0)
The definitions used in the 2006 survey differ from the definitions used in the 2012 and 2017 PPS, so care must be taken with interpretation of results, outlined above.

The results of the 2012 PPS showed an overall HAI prevalence of 4.2%. Pneumonia, surgical site and urinary tract infections were the most common HAIs. The prevalence of antimicrobial use was 29.5%. Gram negative organisms were the most common group of microorganisms.

3. Methodology

3.1. Aims and objectives of the 2017 PPS

The aims and objectives of the PPS 2017 were to:

- Estimate the overall prevalence of HAI and AMU in hospitals in Northern Ireland.
- Identify HAI and AMU by patient demographics, hospital specialities and healthcare facilities.
- Measure the types of HAI and define these by site, microorganism identified and resistance patterns.
- Identify the types of antibiotics prescribed, their indications for use and compliance with quality indicators.
- Capture any emerging antibiotic resistance patterns in comparison with data from the 2012 PPS.
- Describe key structures and processes for the prevention of HAIs and antimicrobial resistance at hospital and ward level in Northern Ireland.
- Report and disseminate the PPS findings at a local, regional and national level and for these findings to help further shape and advise antimicrobial stewardship and infection control measures.
- Contribute data to ECDC European Wide Study in order to create an overall picture of HAI in Europe.
- Compare 2017 findings with the 2012 PPS and to evaluate if local and national priorities have been achieved and if there are any further areas of improvement.

3.2. Timetable and organisation

The Public Health Agency (PHA) coordinated the 2017 Point Prevalence Survey (PPS) of hospital associated infection (HAI) and antimicrobial use (AMU) in Northern Ireland, on behalf of the Department of Health (DoH).

In February 2016, the Deputy Chief Medical Officer wrote to HSC Trust Medical Directors and Trust Directors of Nursing inviting their support and participation in PPS 2017. All acute hospitals in Northern Ireland were encouraged to participate in the survey.

In December 2016, the Assistant Regional Director of Public Health (Health Protection) wrote to all HAI Trust leads inviting them to assemble a PPS team and to nominate a local PPS coordinator. All Trusts replied indicating their willingness to participate and identified a local

coordinator, who would be responsible for liaising with PHA and completing the PPS in their Trust.

HAI surveillance staff in PHA led on the overall coordination of the regional PPS including planning and preparation of survey materials, delivery of survey-specific training, data collection, analysis and reporting of PPS data.

3.3. Study design and limitations

A rolling point prevalence survey was carried out in Northern Ireland hospitals from 6th to 30th June 2017. The Northern Ireland protocol was developed in collaboration with colleagues in Health Service Executive, Ireland (HSE) using the ECDC protocol for PPS (13) (14). Ethical approval was not required as the study was not deemed to be research and was part of a high level audit cycle which will enable individual hospitals to review their own performance. A PPS Delivery Group was established to oversee the survey – membership of this group is attached in Appendix A.1.

A cross sectional survey design is used to conduct prevalence surveys. This means that patients who have a longer inpatient stay are over-represented in the sample and hospital associated infections of a longer duration will also be over represented. Readers should also be aware that the survey measures prevalence on the day the survey was conducted and may not represent the prevalence at all times within the hospital.

One of the main limitations of measuring hospital associated infections is the correct use, by a large number of individuals, of standardised definitions and algorithms. To ensure that the data collected are reliable, a series of in-depth training workshops were held for each Trust and a major validation survey was also undertaken to estimate sensitivity and specificity. The other major limitation of the design is the availability of clinical information and microbiological results. If those who assess patients do not have timely information on samples taken, or do not have access to complete patients notes, then it may affect the accuracy of identifying a hospital associated infection, as only information available at the time of the survey was included and any outstanding results were not followed up after the day of data collection. Readers should be aware that prevalence surveys do not provide information regarding trends and do not allow attribution of the impact of individual interventions to be assessed between surveys, therefore comparisons of results should be treated with some caution as they may be influenced by a complex interplay of survey related and non-survey related factors.

3.4. Training and support

PHA co-ordinated a comprehensive training programme on methodology, organisation of survey, application of case definitions, validation study and interpretation of the survey results.

Nine one-day training courses were delivered by PHA to members of multidisciplinary PPS Teams in the five Health and Social Care (HSC) Trusts. Two additional sessions were held in Belfast. Training sessions were delivered in two parts, (i) why the PPS was being undertaken, methodology and patient eligibility; (ii) training on detailed definitions of hospital associated infection (targeted at infection prevention and control teams, microbiology and pharmacy staff).

A total of 225 staff received PPS-specific training. Feedback on training was collected at the end of each session via a written evaluation form and was largely positive. Participants requested additional case studies to assist with assignment of survey definitions in advance of PPS commencement to facilitate training, a set of case studies was developed addressing specific clinical scenarios, and these were shared with Trusts.

Patient and staff information leaflets were produced and distributed to all participating hospitals. Leaflets provided general information about the survey, see Appendix A.2.and A.3. Members of the PHA team provided on-going support to Trusts throughout the survey period. A helpdesk facility was provided by PHA to support the local data collection teams. This was operational during normal working hours in June and July 2017. Questions regarding data collection, including application of the protocol of definitions, were answered promptly by the PHA PPS Team. 'Frequently Asked Questions' were drafted and shared with Trust PPS Teams.

3.5. Inclusion and exclusion criteria

The survey included all HSC acute and paediatric hospitals. All wards with the exception of day units, psychiatric wards and residential care units within acute hospitals were included. All patients who were admitted to the ward at 8am on the morning of the survey, with the exception of day patients, were eligible for inclusion in the survey. Patients admitted to or transferred into the ward after 8am were excluded. Patients who left the ward before they were surveyed were not followed up and were therefore excluded from the survey.

3.6. Data Collection

Data were collected by members of each Trust's PPS teams. Each data collection team was headed by a local PPS coordinator who was responsible for successful delivery of the PPS at hospital level and also for liaison with PHA PPS team. Local coordinators were responsible for agreeing training arrangements and timetables for data collection.

Each ward surveyed was completed on one day (Monday to Friday); wards where elective procedures were carried out were surveyed between Tuesday and Friday. Data were gathered from a number of sources available on the ward at the time of survey. These included: nursing notes, medical notes, NEWS charts, drug charts, electronic prescribing systems, surgical notes, laboratory reports and other relevant charts, for example care plans. Data collectors were advised to seek clarification from ward staff if the information in the records was not clear.

Data was collected on forms (Appendix A.4 – A.6). After completion the data was entered into a specifically designed web entry programme. Data entry was the responsibility of participating hospitals (15).

3.7. Validation of the 2017 PPS

Gold standard validation study

A gold standard validation study was carried out concurrently with the Northern Ireland PPS using the NI PPS validation protocol (16). The purpose of the study was to assess data validity. ECDC required that all member states undertake a validation study when undertaking PPS as

part of the European Union (EU)-wide PPS and the Northern Ireland protocol was based on the ECDC PPS Validation Protocol. The PHA validation team consisted of six ECDC trained data collectors along with other staff to support the data collection process.

Thirteen of the largest hospitals from the 16 acute hospitals in Northern Ireland were selected for inclusion in the validation study. Purposive sampling was used to select wards for the study; wards with higher expected prevalence (e.g. intensive care units) were oversampled to ensure sufficient HAI/AMU were identified to maximise precision in the validity analysis. All patients in the selected wards were surveyed.

The validation team obtained data using the same sources available to the primary data collection teams in participating hospitals. The sensitivity and specificity for the presence of HAI and antimicrobial use were calculated with 95% CI.

The results from the gold standard validation were used to calculate an adjusted prevalence of HAI that accounted for possible under- or over-reporting by the local data collection teams. The sensitivity and specificity were used to adjust the prevalence and bootstrapping (resampling) methods were used to calculate the 95% CI around the adjusted prevalence.

3.8. Data Management

Data capture was facilitated over the web using Formic Fusion Web Forms software (15) which included internal data checking and validation rules. Data analysis was undertaken using IBM SPSS Statistics 19.0 and data were further quality checked using specifically designed validation routines. A series of predefined reports were generated using IBM SPSS Data Collection Interviewer server Administration - PASW Web reports for surveys (Version 7.0.1). These reports were made available to participating hospitals within eight weeks of the final date of data entry.

3.9. Data Definitions

3.9.1. Hospital Type

Each hospital in Northern Ireland was designated a hospital type using ECDC definitions (14):

Hospital Type	Description
Primary	• Often referred to as 'district hospital' or 'first-level referral'. • Few specialities (mainly internal medicine, obstetrics-gynaecology, paediatrics, general surgery or only general practice). • Limited laboratory services are available for general, but not for specialised pathological analysis. • Often corresponds to general hospital without teaching function.
Secondary	• Often referred to as 'provincial hospital'. • Hospital is highly differentiated by function with five to ten clinical specialities, such as haematology, oncology, nephrology, ICU. • Takes some referrals from other (primary) hospitals. • Often corresponds to general hospital with teaching function.
Tertiary	• Often referred to as 'central', 'regional' or 'tertiary-level' hospital. • Highly specialised staff and technical equipment (ICU, haematology, transplantation, cardio-thoracic surgery, neurosurgery). • Clinical services are highly differentiated by function. • Specialised imaging units. • Provides regional services and regularly takes referrals from other (primary and secondary) hospitals. • Often a university hospital or associated to a university.
Specialised	• Single clinical specialty, possibly with sub-specialties. • Highly specialised staff and technical equipment. • Specify (e.g. paediatric hospital, infectious diseases hospital).

3.9.2. Risk factors

Risk factor data were collected including underlying disease prognosis and National Healthcare Safety Network (NHSN) operative procedure categories (17) and used to categorise patients who had undergone minimally invasive or invasive surgery since admission to hospital. Each patient was assessed for the presence of invasive devices *in situ*, i.e. peripheral vascular catheters (PVC), central vascular catheters (CVC) and urinary catheters (UC).

Underlying disease prognosis – to assess the severity of a patient's condition, clinical opinion was sought on the likely health outcome for each patient included in the PPS. For each patient 'underlying disease prognosis' was captured rather than the 'McCabe Score' as learning arising from an ECDC pilot undertaken in 2010 highlighted that clinicians may be reluctant to code patients to the ultimately fatal and rapidly fatal categories, see Appendix A.7.

3.9.3. HAI definitions

The 2017 European PPS protocol used European definitions of infection and complemented them with case definitions from the Centers for Disease Control and Prevention (CDC), as used by National Healthcare Safety Network (NHSN, formerly NNIS).

There were some changes to SSI, pneumonia and *Clostridium difficile* HAI case definitions in 2017 which are detailed in Appendix A.9.

The infection definitions used in the European PPS were the following:

- Surgical site infection (18)
- Pneumonia (19)
- Bloodstream infection (19)
- Central vascular catheter related infection (19)
- Urinary tract infections (19)
- Clostridium difficile infection (20)
- Specific neonatal definitions – established by the KISS network (21)
- All other case definitions used were CDC/NHSN definitions of infection (17)

This PPS was concerned with active infections acquired *during* or *as a consequence of* admission to an acute hospital. Data were collected on active HAI at the time of survey. HAI was considered active on the basis of the following (see Appendix A.9)

- Patient met one of the HAI case definitions on the day of survey.
  Or
- Patient was receiving antimicrobials for a HAI on the day of survey and the HAI had previously met one of the case definitions between day one of antimicrobial treatment and day of survey.

In addition, onset of HAI must have occurred within one of the following time frames:

- Day 3 of current admission onwards (day of admission is Day 1);
- Present on admission (or presenting on Day 1 or 2) in patients discharged from hospital (acute or non-acute) in previous 2 days;
- Surgical site infection present on admission (or presenting on Day 1 or 2);
- *Clostridium difficile* infection present on admission (or presenting on Day 1 or 2) in patients discharged from hospital (acute or non-acute) in previous 28 days;
- Device-associated infection (pneumonia, UTI, bloodstream infection) following insertion of device (including Day 1 or 2 of admission).

Infections originating in other hospitals were included but those originating in long-term care facilities, care homes, or nursing homes were excluded.

Data were recorded for each HAI including: type, date of onset and origin of infection. Infections that were present on admission to the survey hospital were identified. Additional data were collected to identify whether a relevant device was *in situ* in a defined period prior to onset of infection; specifically central vascular catheter in context of bloodstream infections, intubation in context of pneumonia and urinary catheter in context of urinary tract infections.

3.9.4. Antimicrobial use

Data on antimicrobial use was collected if the patient was:

- Receiving an antimicrobial for treatment or medical prophylaxis at the time of survey *and/or*
- Received at least one dose of surgical prophylaxis prior to 8 a.m. on the survey day.

Antifungal treatment was included in this PPS, but tuberculosis and antiviral treatments were excluded. Data were recorded on each antimicrobial administered including: name of antimicrobial, route of administration, indication for prescription and diagnosis.

The indication for the prescription was recorded as either treatment of infection (community associated; hospital associated; long/intermediate care acquired), surgical prophylaxis (single dose; within 24 hour; >24 hours), medical prophylaxis or reason other than treatment or prevention of infection. The definition of hospital associated infection used when describing the indication for prescription was: an infection that the prescribing clinician considered to be a hospital associated infection or when the symptoms started 48 hours or more after admission to hospital. Diagnosis was defined by the anatomical site of infection being treated or by the site of infection.

Data was gathered to assess three quality indicators for prescribing: (i) if the reason for prescription was recorded in the medical notes (ii) if empirical prescriptions for infection or surgical prophylaxis prescriptions were compliant with local prescribing policy and (iii) if the current antimicrobial represented a change from the original prescription and the reason for change e.g. escalation/de-escalation, IV to oral switch.

Compliance with local prescribing guideline for type of antimicrobial was assessed by Trust PPS Team. Route, dose and duration were not required to be assessed as compliant. If the guideline recommended a combination of two or more antimicrobials, compliance was met if all relevant antimicrobials were prescribed. Antimicrobials were recorded as ‘not assessable’ if any of the following applied:

- Reason for antimicrobial prescription could not be determined from review of the patient’s notes and/or discussion with staff caring for patient
- Medical prophylaxis
- Use of erythromycin as a pro-kinetic agent.
- A local prescribing guideline was not available for the specific infection being treated
- A local surgical antimicrobial prophylaxis guideline was not available for the specific surgical procedure that the patient had undergone
- Patient had a documented antimicrobial allergy which would prevent compliance with local guideline.

3.9.5. Microbiology data

Microbiology data were recorded for HAI when laboratory results were available at the time of survey. Pending laboratory results were not followed up after completion of the survey.

Antimicrobial resistance data were collected for a number of organisms of ECDC defined public health significance; namely *Staphylococcus aureus* (flucloxacillin, glycopeptides), *Enterococcus* spp. (glycopeptides), Enterobacteriaceae (third generation cephalosporins,

carbapenems), *Pseudomonas aeruginosa* (carbapenems), *Acinetobacter baumannii* (carbapenems).

4. Results

4.1.Trusts, Hospitals and Wards

4.1.1. Trusts and Hospitals

All 16 acute care hospitals were included and a total of 3,813 eligible patients were surveyed. Based on returns from each hospital this represented 3813/4331 (88%) of available acute beds. The largest proportion of eligible patients recorded was from Belfast HSC Trust (37% of all patients) followed by South Eastern HSC Trust (17.3%) Northern HSC (15.7%) Western HSC Trust (14.97%) and Southern HSC Trust (14.92%), see Table 2. The change of coverage between the different trusts is also displayed in Table 2. The largest proportion of patients (49.6%) was in a secondary level hospital, and this was the same in the 2012 survey (see Table 3). These data corresponded closely with data from other administrative sources (22).

Table 2 Hospital type, bed numbers and % of patients/beds surveyed

Trust	Number of hospitals	2012 Number eligible patients surveyed	2017 Number eligible patients surveyed	Change in coverage
Total	16	3,992	3,813	-4.48%
Belfast HSC	7	1,617	1,414	-12.5%
South-Eastern HSC	3	675	659	-2.4%
Southern HSC	2	614	569	-7.3%
Western HSC	2	556	571	+2.7%
Northern HSC	2	530	600	+13.2%

Table 3 Hospitals by Type and numbers of patients surveyed

Hospital type	Hospitals	Patient numbers 2012	Patient numbers 2017
Primary	Causeway Hospital Daisy Hill Hospital Downe Hospital Lagan Valley Hospital South West Acute Hospital	672	663
Secondary	Altnagelvin Hospital Antrim Area Hospital Craigavon Area Hospital Mater Infirmorum Hospital Ulster Hospital	1,947	1,892
Tertiary	Belfast City Hospital Royal Victoria Hospital	952	858
Specialised	Belvoir Park Hospital Musgrave Park Hospital Royal Belfast Hospital for Sick Children Royal Jubilee Maternity Service	421	400

4.1.2. Ward specialty

Ward specialties were grouped into seven categories, with the largest proportion of patients being on medical wards (41.9%). Surgical wards represented the 2nd largest ward speciality with 26%. There were 74 (1.9%) patients in Adult ICU, which is a 0.6% reduction since 2012. Overall 227 (6%) of patients were classified in paediatrics and neonatal wards which included paediatric and neonatal ICU. Table 4.

Table 4 Ward specialty

Ward specialty	2012 Number of patients (n=3,992)	% of patients surveyed (95%CI)	2017 Number of patients (n=3,813)	% of patients surveyed (95%CI)
Care of the Elderly	282	7.1 (6.3 - 7.9)	371	9.7 (8.8-10.7)
Adult ICU	99	2.5 (2.0 - 3.0)	74	1.9 (1.5-2.4)
Medical	1,687	42.3 (40.7 - 43.8)	1,597	41.9 (40.3-43.5)
Obstetrics/Gynaecology	385	9.6 (8.8 – 10.6)	329	8.6 (7.8-9.6)
Paediatrics (inc paediatric & neonatal ICU)	178	4.5 (3.9 – 5.1)	227	6.0 (5.2-6.7)
Surgical	1,041	26.1 (24.7 - 27.5)	988	26.0 (24.5-27.3)
Other* (mixed ward, rehabilitation, other)	320	8.0 (7.2 - 8.9)	227	6.0 (5.2-6.7)

*In 2012 psychiatry specialty was included in 'other'; in 2017 this acute specialty was not included in eligible sample

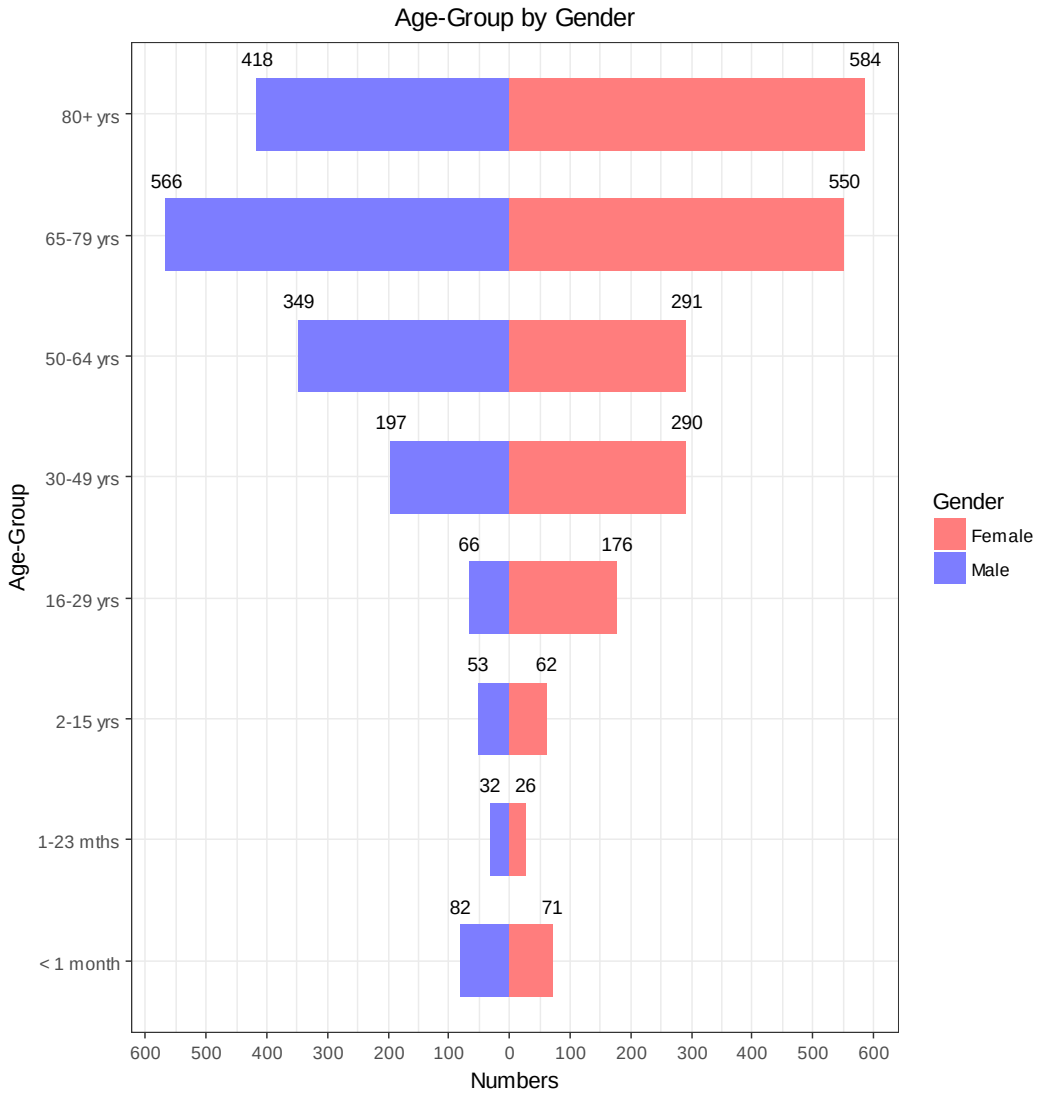
4.2. Patient demographics

Females represented 53.8% of the survey population and males accounted for 46.2%. The median age was 68 years (IQR 46 – 80; range 0 –102) which has increased from 66 years in 2012. The proportion of the population aged less than one month was 4.4% the combined population under age 16 was 8.5%; the proportion aged 16-64 years was 35.9% and aged 65 and over 55.5% (CI 54-57.1), see Table 5 and Figure 1. There has been a statistically significant increase in the proportion of patients aged 65 and over, which was 51.7% (CI 50.2-53.3) in 2012.

Table 5 Demographic characteristics of survey population

Risk factors	2012 Number of patients (n=3,992)	% of patients surveyed (95%CI)	2017 Number of patients (n=3,813)	% of patients surveyed (95%CI)
Gender				
Male	1,823	45.7 (44.1 - 47.2)	1,763	46.2 (44.7 - 47.8)
Female	2,169	54.3 (52.8 - 55.9)	2,050	53.8 (52.2 - 55.3)
Age Group				
< 1 month	186	4.7 (4.1 - 5.4)	168	4.4 (3.8 – 5.1)
1-23 months	96	2.4 (2.0 - 2.9)	43	1.1 (0.8 – 1.5)
2-15 years	101	2.5 (2.1 - 3.1)	115	3.0 (2.5 – 3.6)
16-29 years	299	7.5 (6.7 - 8.4)	242	6.3 (5.6 – 7.2)
30-49 years	590	14.8 (13.7 - 15.9)	487	12.8 (11.8 – 13.9)
50-64 years	654	16.4 (15.3 - 17.6)	640	16.8 (15.6 – 18.0)
65-79 years	1,059	27.4 (26.0 - 28.8)	1,116	29.3 (27.8 – 30.7)
80+ years	974	24.4 (23.1 - 25.8)	1,002	26.3 (24.9 – 27.7)

Figure 1 Population pyramid: Number of patients surveyed by age and sex



4.3. Device usage

Over 6 in 10 (60.3%) of patients (n=2298) had at least one device *in situ* at the time of the survey. Peripheral vascular catheter (either arterial or venous) was the most frequently used device with over half of all patients on the day of the survey having one in situ (52.8%), see Figure 2. This is a statistically significant increase of over nine percentage points since 2012 (43.4%). The ECDC definition of intubation for this survey was 'Patient is intubated with or without mechanical ventilation (endotracheal tube or tracheostomy) at the time of the survey'. Adult ICU had the highest proportion of intubated patients (48.6%).

The use of all devices (CVC, PVC, urinary catheter and intubation) varied across ward specialties, with the highest utilisation seen in Adult ICU – see Table 6.

Figure 2 Proportion of patients with invasive device in situ

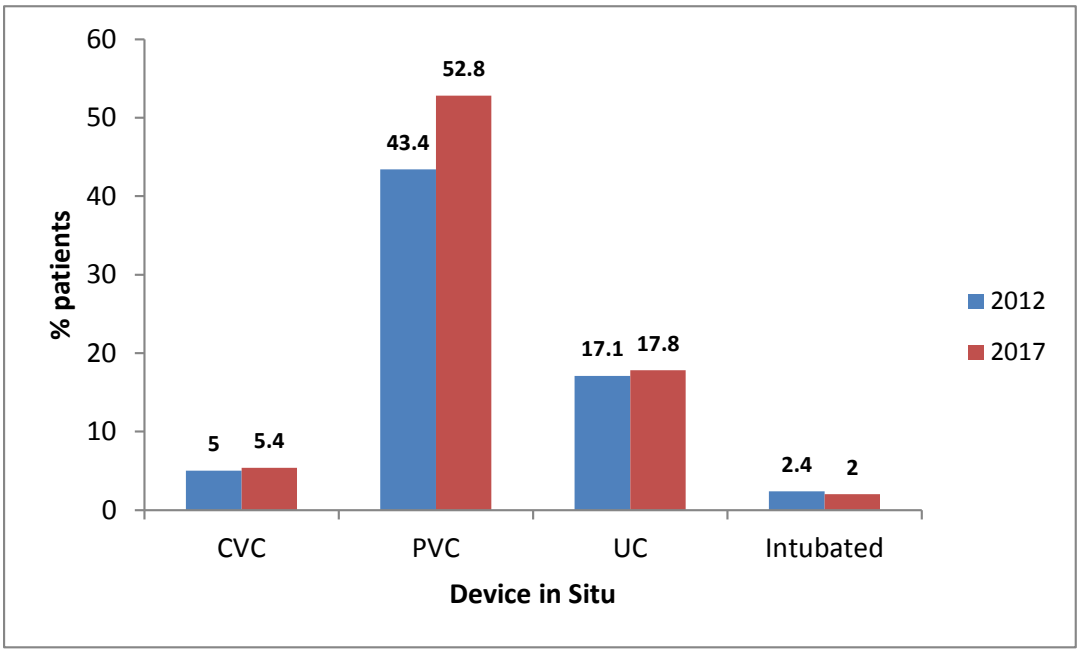


Table 6 2017 - Ward specialty and invasive devices in situ

Ward specialty	Central Vascular Catheter		Peripheral Vascular Catheter		Urinary Catheter		Intubated	
	N	%	N	%	N	%	N	%
All specialties	207	5.4	2013	52.8	679	17.8	78	2.0
Care of the Elderly	2	0.5	123	33.2	54	14.6	0	0.0
Adult ICU	55	74.3	57	77.0	73	98.6	36	48.6
Medical	65	4.1	919	57.5	271	17.0	2	0.1
Obstetrics/Gynaecology	3	0.9	103	31.3	37	11.2	0	0.0
Paediatrics	16	10.3	72	46.5	8	5.2	7	4.5
Neonatal	7	9.7	24	33.3	0	0.0	1	1.4
Surgical	44	4.5	603	61.0	203	20.5	29	2.9
Rehabilitation	0	0.0	6	15.0	3	7.5	0	0.0
Mixed Ward	13	9.8	60	45.5	21	15.9	1	0.8
Other	2	3.6	46	83.6	9	16.4	2	3.6

Table 7 Comparison of invasive devices between 2012 and 2017

All specialities	2012		2017	
Device	N	% (95% CI)	N	% (95% CI)
Central Vascular Catheter	200	5.0% (4.4-5.7)	207	5.4% (4.8-6.2)
Peripheral Vascular Catheter	1733	43.4% (41.9-45)	2013	52.8% (51.2-54.4)
Urinary Catheter	681	17.1% (15.9-18.3)	679	17.8% (16.6-19.1)
Intubated	97	2.4% (2.0-3.0)	78	2.0% (1.6-2.5)

4.4. Intrinsic risk factors – Surgery and underlying disease prognosis

Overall, the proportion of patients who had surgery since admission was 15.9%. Overall 12.6% had an NHSN operative procedure and the remaining 3.3% had minimally invasive surgery, see Table 8.

Definition of NHSN operative procedure is a procedure which:

- Takes place during an operation where at least one incision (including laparoscopic approach) is made through the skin or mucous membrane, or reoperation via an incision that was left open during a prior operative procedure.

And

- Takes place in an operating room, defined as a patient care area that meets criteria for an operating room when it was constructed or renovated. This may include an operating room, C-section room, interventional radiology room, or cardiac catheterisation lab.

NOTE: As of October 2014, incisional closure is no longer a part of the operative procedure definition; all otherwise eligible procedures are included, regardless of closure type.

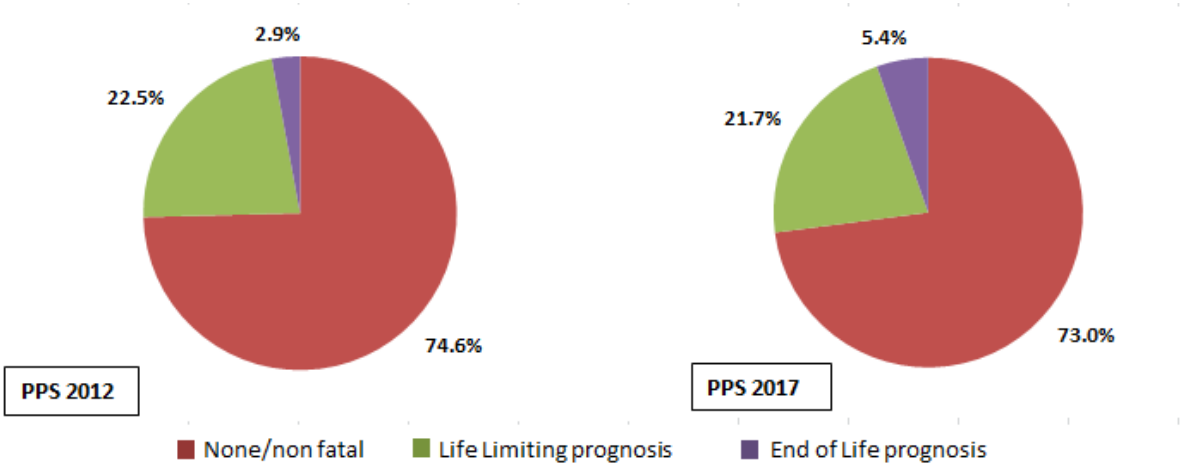
Table 8 Intrinsic risk factors

Risk factors	2012 Number	Percent (95%CI)	2017 Number	Percent (95%CI)
Surgery Since Admission				
Yes (NHSN)	533	13.4 (12.3–14.4)	482	12.6 (11.6-13.7)
Yes (Non-NHSN)	131	3.3 (2.8–3.9)	123	3.3 (2.7-3.8)
No	3,286	82.3 (81.1–83.5)	3181	83.4 (82.2 -84.6)
Not known	42	1.1 (0.8–1.4)	27	0.7 (0.5-1.0)
Underlying Disease Prognosis				
None/Non-fatal	2,792	74.6 (73.1 – 75.9)	2477	73.0 (71.5 – 74.4)
Life limiting prognosis	844	22.5 (21.2 – 23.9)	735	21.7 (20.3 – 23.1)
End of life prognosis	109	2.9 (2.4 – 3.5	18	5.4 (4.7 – 6.2)

Underlying disease prognosis was provided for 89% patients. The majority of patients (73%) had a non-fatal disease prognosis. A further 21.7% were considered to have a life limiting prognosis and 5.4% of patients had an end-of-life prognosis, see Figure 3. There was a statistically significant increase in the percentage of patients with an end-of-life prognosis compared to 2012.

Over sixty-five per cent (65.4%) of those with end-of-life prognosis had a device *in situ* compared to 57.4% with a non-fatal prognosis.

Figure 3 Underlying disease prognosis



4.5. Hospital associated infection (HAI)

4.5.1. HAI prevalence in Northern Ireland

The overall HAI prevalence in Northern Ireland acute care hospitals was 6.1% (95% CI 5.4 – 6.9). A total of 234 patients had 241 infections (the comparable figures for 2012 were 166 patients with 169 infections), the vast majority were identified as having one HAI and only seven patients had two infections reported (the comparable figure for 2012 was three). Comparable rates of HAI for 2011/12 PPS in Europe and UK administrations are shown in Table 9.

Table 9 Prevalence of HAI PPS for Europe and UK 2011/12

Comparable rates of hospital associated infections in Europe and UK		
Country	**HAI prevalence 2011/12**	**HAI prevalence 2016/17**
Europe – ECDC PPS (8)	6.0 (5.9 – 6.1)	To be published
England (Acute) (1)	6.5 (4.8 – 8.8)	To be published
Scotland (Acute) (2) (3)	4.9 (4.4 – 5.4)	4.5 (4.0 – 5.0)
Wales (Acute) (4) (5)	4.3 (3.8 – 4.8)	5.5 (5.0 – 6.1)
Northern Ireland# (6)	4.2 (3.6 – 4.8)	6.1 (5.4 – 6.9)
# if patients in acute psychiatry specialty in 2012 are excluded, the overall HAI rate is 4.3% (CI 3.7 – 5.0)		

4.5.2. HAI prevalence by gender and age

The HAI prevalence for males was 7.7% compared with 4.8% for females, and this difference was statistically significant, Table 10. The prevalence of HAI was highest for those aged 1-23 months (9.3%).

Table 10 Distribution of HAI by gender and age group

Risk factors	**2012**	**2017**		
	HAI prevalence	**Number of patients (n=3,813)**	**Number of patients with HAI**	**HAI prevalence % (95%CI)**
Gender				
Male	4.7 (3.8-5.8)	1763	135	7.7 (6.5-9.0)
Female	3.7 (3.0-4.6)	2050	99	4.8 (4.0-5.8)
Age Group				
< 1 month	1.6 (0.6-4.6)	168	14	8.3 (5.0-13.5)
1-23 months	8.3 (4.3-15.6)	43	4	9.3 (3.7-21.6)
2-15 years	2.0 (0.5-6.9)	115	0	0.0 (0.0-3.2)
16-29 years	2.0 (0.9-4.3)	242	4	1.7 (0.6-4.2)
30-49 years	3.1 (1.9-4.8)	487	29	6.0 (4.2-8.4)
50-64 years	5.8 (4.3-7.9)	640	35	5.5 (4.0-7.5)
65-79 years	4.3 (3.3-5.7)	1116	85	7.6 (6.2-9.3)
80+ years	4.5 (3.4-6.0)	1002	63	6.3 (4.9-8.0)

4.5.3. HAI prevalence by hospital type

All 16 hospitals in Northern Ireland were coded to the same hospital type as in 2012 (see Table 3). In both 2012 and 2017, tertiary hospitals had the highest HAI prevalence (6.8% and 6.9% respectively).

Since the 2012 survey, there has been a significant increase in the HAI prevalence in secondary hospitals from 3.2% to 6.2%. The HAI prevalence has also increased in the other three hospital types. When HAI prevalence was compared for individual hospitals within each hospital type, i.e. Tertiary, Secondary, Primary and Specialised, there was considerable overlap in the rates except for secondary hospitals where one unit had higher rates in comparison with others in the same group, see Figure 4.

The lowest prevalence of HAI (5.1%) was in primary hospitals, see Table 11.

Figure 4 HAI prevalence for individual hospitals by hospital type

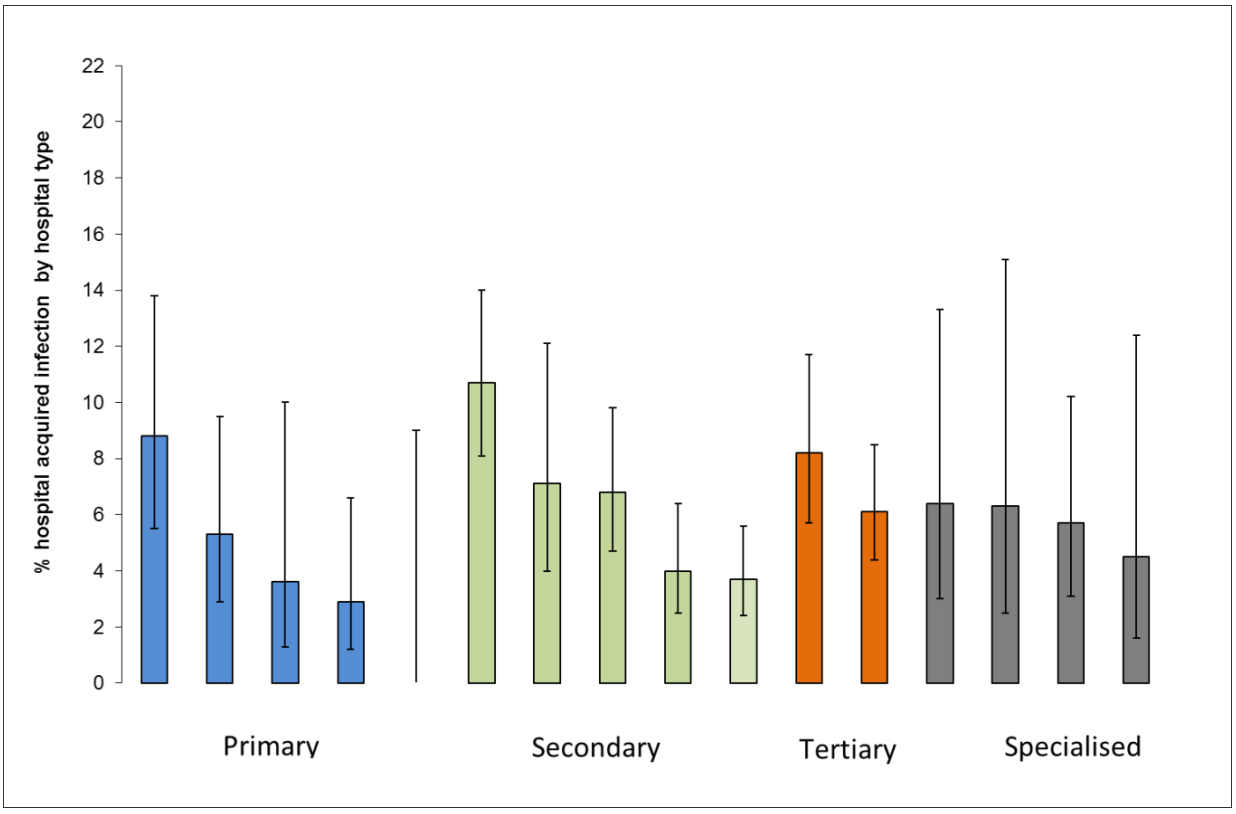


Table 11 Distribution of HAI by hospital type

Hospital type	2012	2017		
	HAI prevalence % (95%CI)	Number of patients	Number of HAI	HAI prevalence % (95%CI)
Primary	2.2 (1.4 – 3.7)	663	34	5.1 (3.7-7.1)
Secondary	3.2 (2.6 – 4.2)	1892	124	6.2 (5.2-7.4)
Tertiary	6.8 (5.8 – 9.2)	858	60	6.9 (5.4-8.8)
Specialised	5.7 (4.1 – 8.8)	400	23	5.8 (3.9-8.5)

4.5.4. HAI increase by hospital type

As the increase in the number of hospital associated infections tended to be concentrated in primary and secondary type hospitals, an analysis of the type of infections was undertaken by comparing the data for 2012 with that collected in 2017. In 2017, the number of infections in both primary and secondary type hospitals was double the number observed in 2012 – from 15 to 34 HAI in primary hospitals and 62 to 124 in secondary level hospitals (see Figure 5a-5d).

In secondary hospitals, an increase in infections was identified for: pneumonia, bloodstream, gastrointestinal, neonatal, skin and soft tissue and eye, ear, nose, throat and mouth infections.

Figure 5 (a) Type of hospital associated infection – Primary hospitals 2012 & 2017

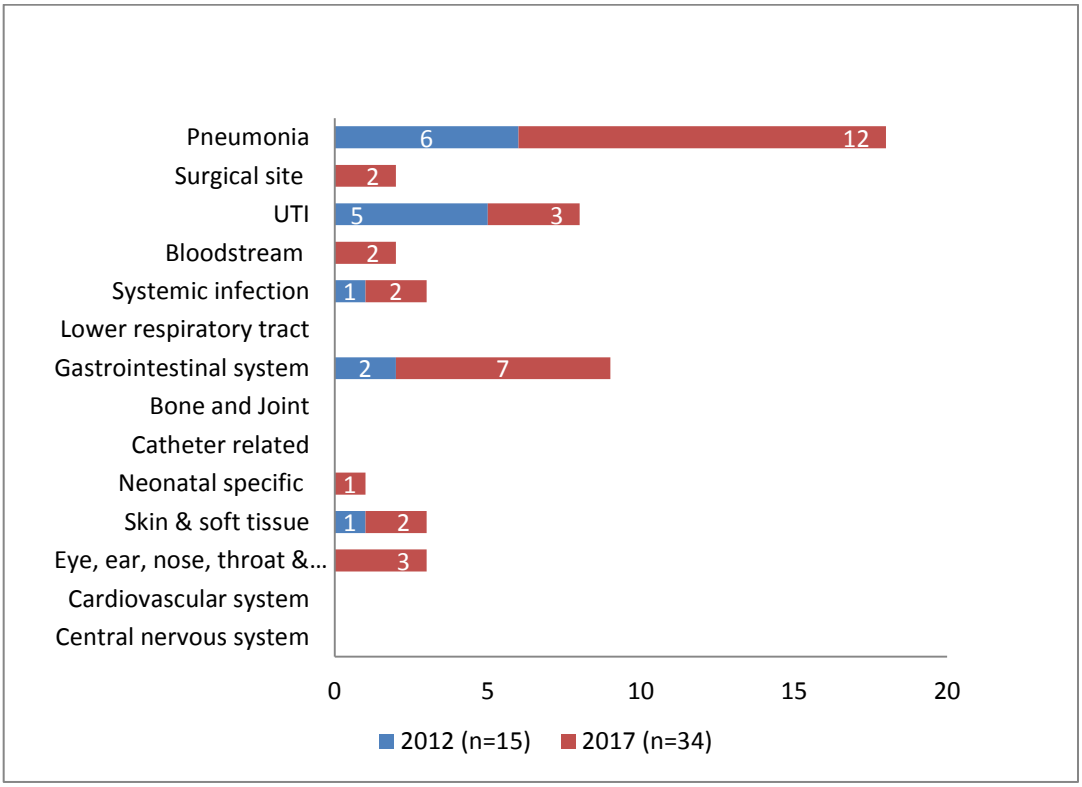


Figure 5 (b) Type of hospital associated infection – Secondary hospitals 2012 & 2017

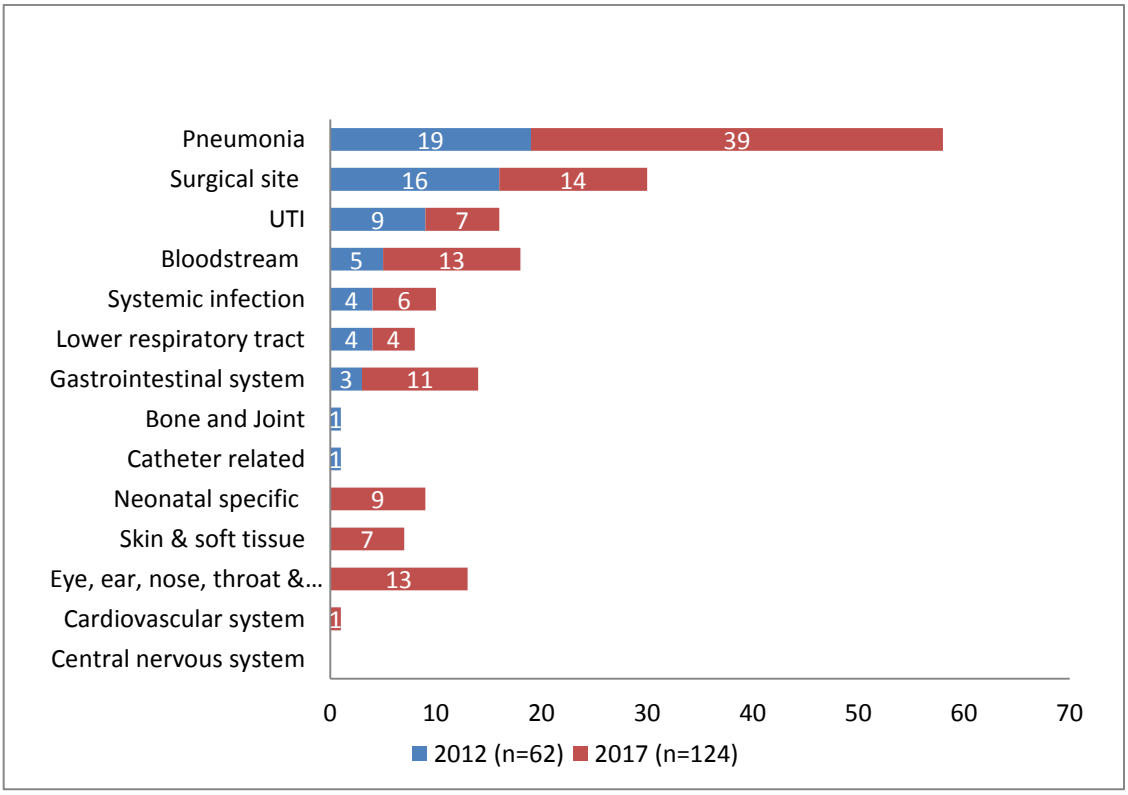


Figure 5 (c) Type of hospital associated infection – Tertiary hospitals 2012 & 2017

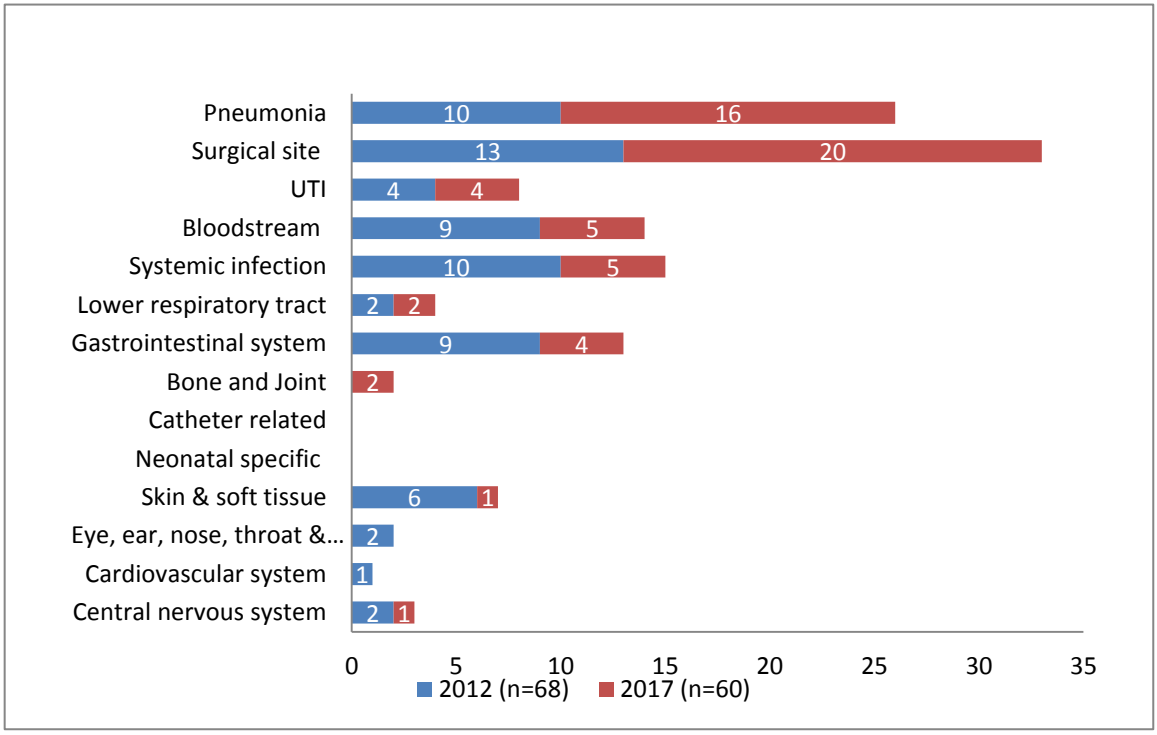
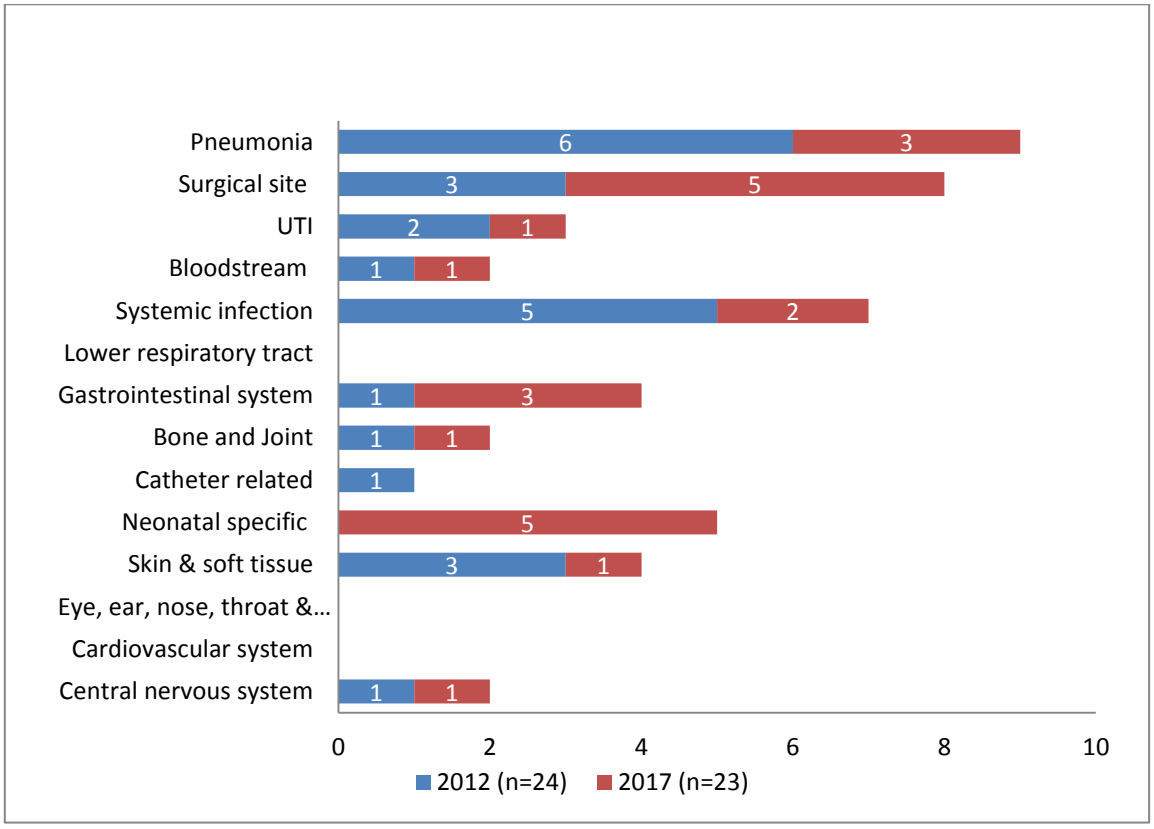


Figure 5 (d) Type of hospital associated infection – Specialised hospitals 2012 & 2017



4.5.5. HAI prevalence by risk factors

While the overall HAI prevalence was 6.1%, if a patient had a device *in situ* the HAI prevalence was significantly higher (8.4%). The presence of each device was associated with higher HAI prevalence: central vascular catheter (HAI prevalence 14.9%, $p < 0.01$), peripheral vascular catheter (HAI prevalence 8.6%, $p < 0.01$), urinary catheter (HAI prevalence 12.5%, $p < 0.01$) and intubation (HAI prevalence 11.5%, $p < 0.01$), see Table 12.

This was similar to 2012 where all four invasive devices included in the survey also had a higher prevalence of HAI.

Almost one in five patients (19.6%) who has a central vascular catheter, peripheral vascular catheter and urinary catheter in situ were diagnosed with an hospital associated infection, but this related to a small number of cases (10 out of 51 patients).

A total of 632 patients (16.6%) had some form of surgery (operative procedure or minimally invasive procedure) since admission. Prevalence of HAI was higher for patients having undergone surgery than for those who did not have surgery (11.2% versus 5.1%; $p<0.01$).

Higher HAI prevalence was observed in patients with a life-limiting prognosis (7.8%) or end-of-life prognosis (8.2%) compared with those with non-fatal prognosis (5.6%), $p<0.01$.

Table 12 Distribution of HAI by intrinsic risk factors

Risk factors	2012	2017		
	HAI prevalence % (95%CI)	Number of patients (n=3,813)	Number with HAI	HAI prevalence % (95%CI)
Invasive device in situ				
Any device – Yes	7.1(6.1 – 8.3)	2,298	194	8.4 (7.4 – 9.6)
Any device – No	1.1 (0.7 – 1.6)	1,515	40	2.6 (1.9 – 3.6)
CVC	20.5 (15.5 – 26.6)	207	31	14.9 (10.8 – 20.5)
PVC	6.3 (5.3 – 7.6)	2,013	174	8.6 (7.5 – 10.0)
Urinary catheter	9.4 (7.4 – 11.8)	679	85	12.5 (10.2 – 15.2)
Intubation	16.5 (10.4 – 25.1)	78	9	11.5 (6.2 – 20.5)
Surgery Since Admission				
Yes	7.8 (6.0 – 10.0)	632	71	11.2 (9.0-13.9)
No	3.4 (2.8 – 4.1)	3181	163	5.1 (4.4-5.9)
Underlying Disease Prognosis				
None/Non-fatal	3.0 (2.4 – 3.7)	2477	139	5.6 (4.8-6.6)
Life limiting prognosis	7.0 (5.5 – 8.9)	735	57	7.8 (6.0-9.9)
End of life prognosis	8.3 (4.4 – 15.0)	182	15	8.2 (5.1-13.2)
Not Known	6.1 (3.7 – 9.8)	419	23	5.5 (3.7-8.1)

4.5.6. HAI prevalence by ward specialty

HAI prevalence varied across ward specialties, with the highest prevalence in ICU (17.6%) followed by mixed specialty wards (7.6%), Care of the Elderly (7.5%) and Paediatrics (7.0%).

The lowest HAI prevalence was found in 'Other' wards (including rehabilitation) where no HAI were recorded, see Table 13.

Table 13 Distribution of HAI by ward specialty

Ward specialty	2012	2017			
	HAI prevalence % (95%CI)	Number	% total patients	Number with HAI	HAI prevalence % (95%CI)
All ward specialties	4.2 (3.6 – 4.8)	3,813	100.0	234	6.1 (5.4 – 6.9)
Adult ICU	9.1 (4.7 – 16.4)	74	1.9	13	17.6 (10.6 – 27.8)
Care of the Elderly	5.7 (3.5 – 9.0)	371	9.7	28	7.5 (5.3 – 10.7)
Surgical	5.2 (4.0 – 6.7)	988	25.9	65	6.6 (5.2 – 8.3)
Paediatrics (inc. paediatric ICU & Neonatal)	4.5 (2.3 – 8.6)	227	5.9	16	7.0 (4.4 – 11.1)
Medical	4.0 (3.1 – 5.0)	1597	41.9	87	5.4 (4.4 – 6.7)
Mixed specialty wards	-	132	3.5	10	7.6 (4.2 – 13.4)
Other (other, rehab)	2.8 (1.5 – 5.3)	95	2.5	0	0 (0.0 – 3.9)
Obstetrics/Gynaecology	0.8 (0.3 – 2.3)	329	8.6	15	4.6 (2.8 – 7.4)

4.5.7. HAI prevalence for paediatric patients

Paediatric patients were defined as those aged less than 16 years, whether on an adult or paediatric ward. There were 326 paediatric patients surveyed with 16 on adult wards. There were 18 patients with HAI, the most prevalent HAI was clinical sepsis in neonates (n=10; 55.6% of paediatric HAI), see Table 14.

The prevalence of HAI in the paediatric population was 5.5% (95%CI 3.5% – 8.6%). Neonates on postnatal wards, 'well babies' (n=86) had a low HAI prevalence (2.3%). HAI prevalence in paediatric patients, excluding 'well babies', was 2.0% (95%CI 0.7 – 5.6). HAI prevalence in Neonatal (including neonatal ICU) was 18.1%.Table 15.

Table 14 Distribution of paediatric HAI types

HAI groups	Number of HAI	% of paediatric HAI
Clinical sepsis in neonates	10	55.6
Laboratory confirmed bloodstream infection non-CNS (NEO)	2	11.1
Laboratory confirmed bloodstream infection with coagulase-negative staphylococci (NEO)	1	5.6
Skin infection	1	5.6
Pneumonia (NEO)	1	5.6
Symptomatic urinary tract infection	1	5.6
Intracranial infection	1	5.6
Necrotising enterocolitis (NEO)	1	5.6

Table 15 2017 Distribution of Paediatric HAI by ward specialty

Ward specialty	Total patients	Number with HAI	HAI prevalence % (95%CI)
Total paediatric	326	18	5.5 (3.5 – 8.6)
Neonatal	72	13	18.1 (10.9 – 28.5)
Gynaecology/Obstetrics	86	2	2.3 (0.6 – 8.1)
Paediatrics	152	3	2.0 (0.7 – 5.6)
Surgery	10	0	-
Medicine	4	0	-
Intensive care	2	0	-

4.5.8. HAI categories

The number, proportion and prevalence of HAI by infection category are shown in Table 16 and by HAI type in Appendix B, Table I. The most common HAI category was pneumonia (29.0%), followed by surgical site infection (17.0%), gastrointestinal system infection (10.4%), bloodstream infection (8.7%) and ENT infection (6.6%).

Table 16 Distribution of HAI categories

HAI category	2012		2017		
	% of all HAI	HAI prevalence (95%CI)	Number HAI	% of all HAI	HAI prevalence % (95%CI)
Pneumonia	24.3	1.0 (0.8 – 1.4)	70	29.0	1.8 (1.5-2.3)
Surgical site infection	18.9	0.8 (0.6 – 1.1)	41	17.0	1.1 (0.8-1.5)
Urinary tract infection	11.8	0.5 (0.3 – 0.8)	15	6.2	0.4 (0.2-0.6)
Systemic infection	11.8	0.5 (0.3 – 0.8)	15	6.2	0.4 (0.2-0.6)
Bloodstream infection	8.9	0.4 (0.2 – 0.6)	21	8.7	0.6 (0.4-0.8)
Gastrointestinal system infection	8.9	0.4 (0.2 – 0.6)	25	10.4	0.7 (0.4-1.0)
Skin & soft tissue infection	5.9	0.3 (0.1 – 0.5)	11	4.6	0.3 (0.2-0.5)
Lower respiratory tract infection, other than pneumonia	3.6	0.2 (0.1 – 0.3)	6	2.5	0.2 (0.1-0.3)
Central nervous system infection	1.8	0.1 (0.0 – 0.2)	2	0.8	0.1 (0.0-0.2)
Vascular catheter-related infection	1.2	0.1 (0.0 – 0.2)	0	-	-
Bone and joint infection	1.2	0.1 (0.0 – 0.2)	3	1.2	0.1 (0.0-0.2)
Eye, ENT or mouth infection	1.2	0.1 (0.0 – 0.2)	16	6.6	0.4 (0.3-0.7)
Cardiovascular system infection	0.6	<0.1 (0.0 – 0.1)	1	0.4	<0.1 (0.0-0.1)
Neonatal Specific Infection	0	0.0	15	6.2	8.9 (5.5-14.2)
Total number of HAI	166	4.2 (3.6 – 4.8)	241	100.0	6.1 (5.4 – 6.9)

Pneumonia

A total of 70 pneumonia infections were identified in the survey, only 3 patients had a relevant device *in situ* before onset, i.e. intubated within 48 hours before onset (known as ventilator-associated pneumonia or VAP). The definition of pneumonia was subdivided into 5 categories (PN1 to PN5). PN1 to PN3 required microbiological confirmation and PN4 and PN5 were defined as clinical pneumonia without microbiological evidence. The vast majority of pneumonia identified in Northern Ireland were classified as PN4 (n=6) or PN5 (n=63).

Surgical site infection (SSI)

A total of 41 surgical site infections (SSI) were identified; one quarter (24.4%) were deep incisional infections and half (48.8%) were organ space infections .The surgical site procedure categories that were linked with SSI are shown in Table 17. Appendix B, Table II contains a list of specific surgical procedures and their associated HAI and antimicrobial use. Eleven (26.8%) SSI followed general surgery, eight of these were deep incisional/organ space infections and three were superficial. Eight surgical site infections occurred following orthopaedic surgery, six of these were deep or organ space infections and two were superficial incisional.

Table 17 Prevalence of surgical site infection by surgical procedure category

Surgical category	Number	% of SSI	Superficial	Deep incisional and Organ space
Total	41	100.0	11 (26.8%)	30 (73.2%)
General surgery	11	26.8	3	8
Cardiac surgery	2	4.9	2	0
Neurosurgery	2	4.9	0	2
Orthopaedics	8	19.5	2	6
Obstetrics & Gynaecology	7	17.1	2	5
Vascular surgery	2	4.9	0	2
Urology/kidney transplant	3	7.3	1	2
Not recorded	6	14.6	1	5

Urinary tract infection (UTI)

A total of 15 UTI (6.2%) were recorded. This was a lower proportion than in the 2012 survey - 20 (11.8%). Nine of the infections (60%) were microbiologically confirmed, and six had signs and symptoms but were not microbiologically confirmed. Five of the patients with a UTI (33%) had a urinary catheter *in situ* in the seven days prior to onset of infection, i.e. catheter associated urinary tract infection (CAUTI).

Systemic infection

There were 15 systemic infections identified. Thirteen were classified as clinical sepsis, i.e. the patients presented with clinical signs/symptoms but with no other recognised cause and treatment for sepsis was started. The remaining two cases were reported as a disseminated infection involving multiple organs and systems.

Eye, ENT or mouth infection

Sixteen patients were recorded as having an eye, ear, nose, throat or mouth infection (6.6%). This was a significant increase since 2012 when only 2 patients were recorded. All 16 were oral cavity infections and 9 of these patients were age 80+ (56.2%).

The majority of prescriptions (81.2%) were for Nystatin, which is commonly used for the treatment of oral thrush. Only one infection had an identified microorganism.

Bloodstream infection (BSI)

Table 18, provides information on the source of bloodstream infections (BSI). There were 21 BSIs identified in adults and three in neonates. Of these, eleven (45.8%) were primary BSIs and 13 were secondary blood stream infections. Thirteen infections were classified as secondary to other infections and four were infections secondary to UTI.

Table 18 Source of bloodstream infections

	2012		2017	
Source of BSI	**Number**	**% of BSI**	**Number**	**% of BSI**
Total BSI	15	100%	24	100%
Primary BSI	12	80.0	11	45.8
BSI of unknown origin	9		8	
Vascular Catheter related	3		3	
Secondary BSI	3	20.0	13	54.2
Secondary to urinary tract infection	2		4	
Secondary to pulmonary infection	0		2	
Secondary to digestive tract infection	1		2	
Secondary to SSI	0		0	
Secondary to skin & soft tissue inf	0		1	
Secondary to other infection	0		4	

Gastrointestinal system infections (GI)

The number of gastrointestinal system infections was 25. Half of *Clostridium difficile* infections (n=7) were found in patients aged over 80 years. Six intra-abdominal GI infections were recorded relating either to gall bladder, bile duct, liver, spleen, pancreas, peritoneum or sub phrenic/sub diaphragmatic space. The five remaining GI infections included: oesophagus, stomach, small and large bowel and rectum.

4.5.9. HAI onset and origin

Almost four-fifths (77.2%) of HAI (186 of 241) developed following admission to the survey hospital; the remaining 55 (22.8%) were present on admission. Of those HAI present on admission, 30 (54.5%) were readmissions, the remaining 25 infections were related to another hospital.

The median time from admission to onset of infection, for patients with an HAI which was not present at admission, was 9 days, 40.9% developed within the first week and 65.6% within the first fortnight. The proportion of HAI which developed more than three weeks after admission was 18.8% - see Table 19.

Table 19 Onset of HAI for all infections

	2012		2017	
Onset (admission to infection date)	**Number**	**% of total HAI**	**Number**	**% of total HAI**
up to one week	75	46.3	76	40.9
8-14 days	38	23.5	46	24.7
15-21 days	15	9.3	29	15.6
22 days or more	34	21.0	35	18.8

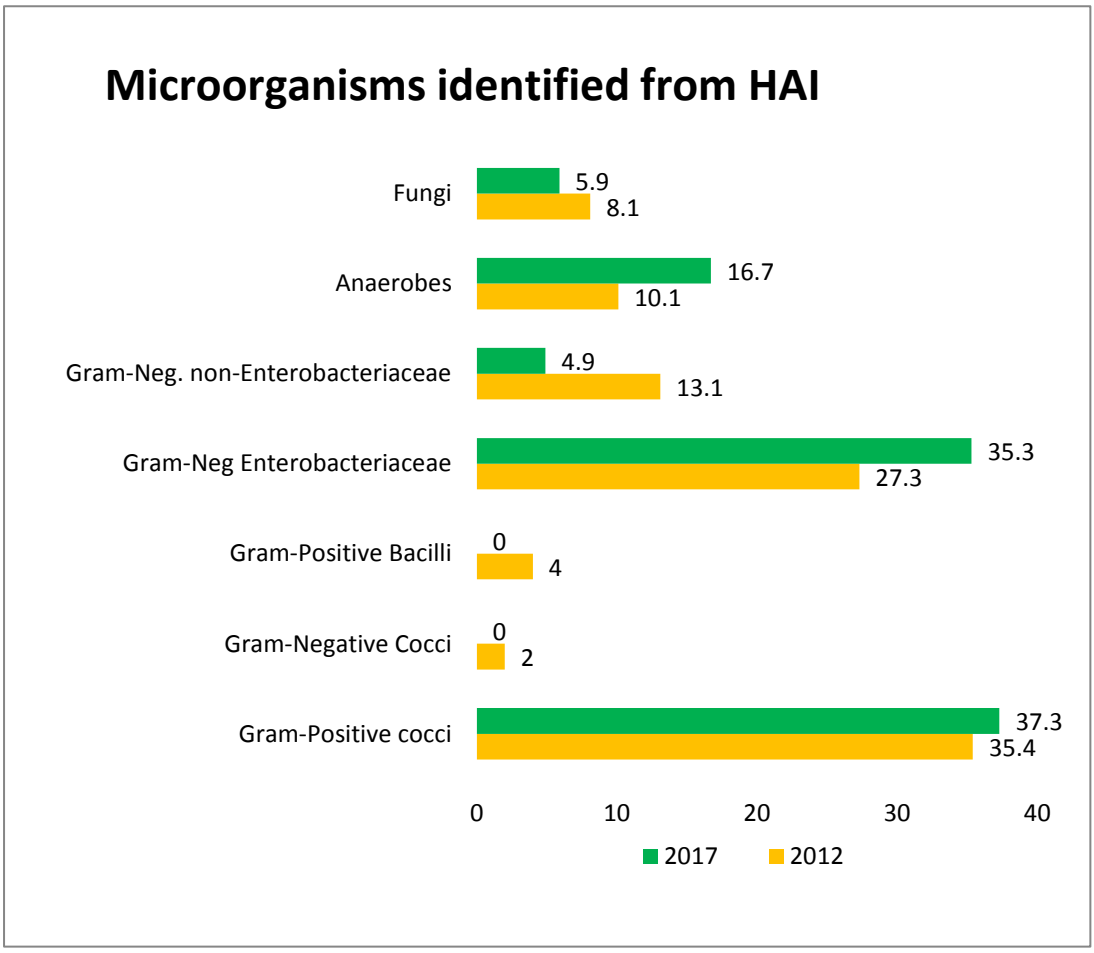
5. Microbiology results

5.1. Microorganisms

One third (35.3%) of infections had positive microbiology available, the remaining infections were determined on the basis of clinical signs and symptoms. A total of 102 microorganisms were reported for 241 infections (up to three microorganisms could be recorded per infection). Positive microbiology results were not available in approximately two thirds of HAI, either because the result was not available (27.3%), the examination was not done (29.9%), microorganism was not identified (7.5%) or a sterile specimen was received (0.4%).

Gram-positive cocci were the most frequently recorded organisms accounting for 37.3% of all microorganisms (*Staphylococcus aureus 18.6% and Enterococcus spp*. *9.8%*); followed by gram-negative Enterobacteriaceae 35.2% (*Escherichia coli 20.6%* was the most common organism in this group).The proportion of anaerobic bacilli was 16.7%, with *Clostridium difficile* being the most common at 12.7%, followed by Fungi and Gram negative non-enterobacteriaceae - 5.9% and 4.9% respectively - see Figure 6 and Table 20.

Figure 6 Classification of microorganisms



A detailed breakdown of microorganisms for the most common HAIs (pneumonia/LRTI, SSI, UTI, BSI and GI) is shown in Appendix B Table VI

Table 20 Microorganisms in Northern Ireland PPS 2012 & 2017

Microorganisms	Number in 2012	% of total	Number in 2017	% of total
Total	99	100	102	100
Gram-positive cocci	35	35.4	38	37.3
Staphylococcus aureus	14	14.1	19	18.6
Coag. negative staphylococci	7	7.1	5	4.9
***Streptococcus* spp.**	2	2.0	3	3.0
***Enterococcus* spp.**	12	12.1	10	9.8
Other gram positive or not specified	0	-	1	1.0
Gram-negative cocci	2	2.0	0	-
Gram-positive bacilli	4	4.0	0	-
Gram-negative Enterobacteriaceae	27	27.3	36	35.3
***Citrobacter* spp.**	2	2.0	0	-
***Enterobacter* spp.**	2	2.0	1	1.0
Escherichia coli	8	8.1	21	20.6
***Klebsiella* spp.**	3	3.0	5	4.9
***Proteus* spp.**	10	10.1	3	2.9
***Serratia* spp.**	1	1.0	1	1.0
***Hafnia* spp.**	0	-	1	1.0
Other Enterobacteriaceae	1	1.0	4	3.9
Gram-neg. non-enterobacteriaceae	13	13.1	5	4.9
Acinetobacter baumannii	0	-	1	1.0
Pseudomonas aeruginosa	4	4.0	2	1.9
Stenotrophomonas maltophilia	1	1.0	0	-
Pseudomonadaceae family, other	4	4.0	1	1.0
***Haemophilus* spp.**	1	1.0	0	-
Other Non-enterobacteriaceae	3	3.0	1	1.0
Anaerobic Bacilli	10	10.1	17	16.7
Clostridium difficile	8	8.1	13	12.7
Other Anaerobes	2	2.0	4	3.9
Fungi	8	8.1	6	5.9
***Candida* spp.**	7	7.1	4	3.9
Other Parasites	1	1.0	2	2.0

5.2. Microbiology – Antimicrobial sensitivity

The number of reports for microorganisms of public health importance, as defined by European Centre for Disease Prevention and Control (ECDC), and their sensitivity to selected antimicrobials is shown in Table 21. Sensitivity data were reported for 16 *Staphylococcus aureus* isolates -13 meticillin sensitive (MSSA) and 3 meticillin resistant (MRSA). In total 36 Enterobacteriaceae isolates had sensitivity data reported. Of these sixteen were sensitive to both third generation cephalosporins and carbapenems; one was resistant to third generation cephalosporins but sensitive to carbapenems; none were identified as resistant to both third generation cephalosporins and carbapenems. Ten *Enterococcus* spp. isolates had

sensitivity data, four were glycopeptide sensitive but a further 4 were resistant, with two results unknown at the time of the survey. One *Acinetobacter baumannii* was recorded which was sensitive to carbapenem. Two *Pseudomonas* isolates were identified, but resistance results were not available for either of these.

Table 21 ECDC-defined antimicrobial resistance

Microorganism	Sensitivity	Number	%
Staphylococcus aureus	Meticillin or sensitive (MSSA)	13	81.2
	Meticillin or resistant (MRSA)	3	18.8
	Total	16	100%
***Enterococcus* spp.**	Glycopeptide sensitive	4	40.0
	Glycopeptide resistant	4	40.0
	Not recorded	2	20.0
	Total	10	100%
Enterobacteriaceae*	3rd generation cephalosporin sensitive + carbapenem sensitive	16	44.4
	3rd generation cephalosporin resistant + carbapenem sensitive	1	2.8
	3rd. generation cephalosporin resistant + carbapenem resistant	0	0.0
	Not recorded	19	52.8
	Total	36	100%
Acinetobacter baumannii	Carbapenem sensitive	1	100.0
	Carbapenem resistant	0	0.0
	Not recorded	0	0.0
	Total	1	100%

* Enterobacteriaceae: *Escherichia coli, Klebsiella* spp., *Enterobacter* spp., *Proteus* spp., *Citrobacter* spp., *Serratia* spp., *Morganella* spp.

6. Antimicrobial use

6.1. Antimicrobial use in Northern Ireland

A total of 1,385 patients were receiving 2,073 antimicrobials at the time of the survey. The overall prevalence of antimicrobial use was 36.3% (95%CI 34.8 – 37.9). Appendix B Table III shows a detailed breakdown of HAI and antimicrobial use by patient risk factors. Comparable rates of antimicrobial use in Europe and UK administrations are shown in Table 22.

Table 22 Prevalence of antimicrobial use for 2012 & 2017 PPS in Europe and UK

Country	AMU prevalence 2011/12	AMU prevalence 2016/17
Europe – ECDC PPS	35.0 (34.8 – 35.2)	To be published
England (Acute) (1)	34.3 (30.1 – 39.2)	To be published
Scotland (Acute) (2) (3)	32.3 (30.9 – 33.8)	35.3 (33.8 – 36.7)
Wales (Acute) (4) (5)	32.7 (31.6 – 33.9)	34.2 (33.0 – 35.3)
Northern Ireland	29.5 (28.1 – 30.9)	36.3 (34.8 – 37.9)

The number of antimicrobials prescribed per patient is shown in Table 23. A total of 127 patients were receiving three or more antimicrobials, i.e. 3.3% of the total hospital population and 9.2% of those receiving antimicrobials.

Table 23 Number of antimicrobials prescribed per patient in 2012 & 2017

Number of antimicrobials per patient	2012 Number of patients	% patients	2017 Number of patients	% patients
Zero	2,814	70.5	2428	63.7
One	744	18.6	851	22.3
Two	324	8.1	407	10.7
Three	84	2.1	102	2.7
Four	23	0.6	23	0.6
Five or more	3	0.1	2	0.1

Over one third of males (37.5%) received antimicrobials and the proportion for females was similar at 35.3%. The percentage of patients aged 0- 64 receiving antimicrobials was 32.3%, significantly lower ($p<0.01$) than those aged 65 or over (39.6%), see Table 24.

Table 24 Prevalence of antimicrobial use by age group 2012 & 2017

Age group	2012 Antimicrobial use prevalence % (95%CI)	2017 Number (n=3,813)	Number receiving antimicrobials	Antimicrobial use prevalence % (95%CI)
< 1 month	12.4 (8.4– 17.9)	168	33	19.6 (14.3-26.3)
1-23 months	28.1(20.1–37.8)	43	16	37.2(24.4-52.1)
2-15 years	36.6 (27.9–46.4)	115	31	27.0 (19.7-35.7)
16-29 years	23.4 (19.0–28.5)	242	79	32.6 (27.0-38.8)
30-49 years	25.3 (21.9–28.9)	487	154	31.6 (27.6-35.9)
50-64 years	32.9 (29.4–36.6)	640	234	36.6 (32.9-40.4)
65-79 years	34.5 (31.8–37.4)	1,116	452	40.5 (37.7-43.4)
80+ years	28.7 (26.0–31.7)	1,002	386	38.5 (35.6-41.6)

6.2. Antimicrobial use – Route of administration and reason in notes

Over six in ten of all antimicrobials were administered parenterally (62.4%), followed by oral (37.0%) – see Table 25. A larger proportion of those aged 0-65 years received antimicrobials parenterally compared with those aged over 65 years (68.7% and 58.3% respectively).

Table 25 Antimicrobial use – Route of administration 2012 & 2017

Route of administration	2012 - Number antimicrobials	2017 - Number antimicrobials	% of all antimicrobials (95%CI)
Parenteral	1,139 (65.2)	1,294	62.4 (60.3 – 64.6)
Oral	606 (34.6)	767	37.0 (34.9 – 39.2)
Inhalation	3 (0.2)	4	0.2 (0.0 - 2.4)
Unknown	3 (0.2)	8	0.4 (0.0 – 2.6)

Information was collected on whether the reason for prescribing was recorded in the medical notes or drug chart by a clinician. This was recorded for 1,941 antimicrobials (93.6% of the total), see Table 26.

Table 26 Antimicrobial use – Reason in notes 2012 & 2017

Reason in notes	2012 Number antimicrobials	% of all antimicrobials (95%CI)	2017 Number of antimicrobials	% of all antimicrobials (95%CI)
Yes	1,587	90.6 (89.2 – 91.9)	1,941	93.6 (92.7 - 94.6)
No	113	6.5 (5.4 – 7.7)	114	5.5 (4.5 - 6.5)
Notes not available	51	2.9 (2.2 – 3.8)	13	0.6 (0 - 1.6)

6.3. Antimicrobial use – Indication for prescribing

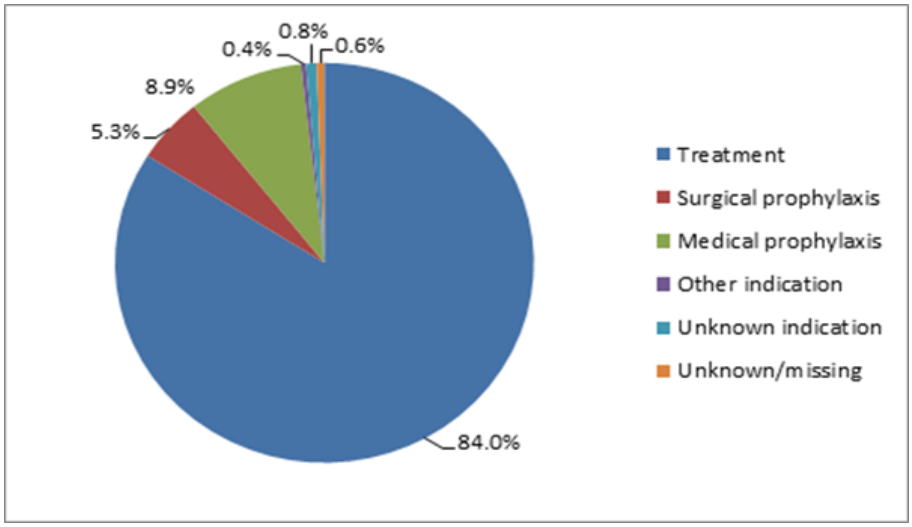
The most common reason for antimicrobial prescribing was for infections considered to be community acquired. There were 861 patients treated for community acquired infection or 22.6% of the hospital population. Treatment of community acquired infection accounted for 60.6% of all prescribed antimicrobials.

Surgical prophylaxis and medical prophylaxis accounted for 5.3% and 8.9% of all antimicrobials respectively, see Table 27 and Figure 7. Surgical prophylaxis continued for more than 24 hours in 23.3% of cases (20/86). Appendix B Table IV shows antimicrobial agents by indication for use.

Table 27 Antimicrobial use – Indication for prescribing

Indication for antimicrobial use	2012 Number of patients	2012 % antimicrobials (95%CI)	2017 Number patients	2017 Number antimicrobials	2017 % antimicrobials (95%CI)
Total	1,178	100%	1,385	2,073	100%
Treatment	940	80.5 (78.6 – 82.3)	1,183	1,741	84.0 (82.3 – 85.5)
Community infection	714	60.1 (57.8 – 62.4)	861	1,256	60.6 (58.5 - 62.7)
Hospital infection	201	18.3 (16.5 – 20.2)	307	445	21.5 (19.3 - 23.6)
Other HAI	25	2.1 (1.5 – 2.9)	28	40	1.9 (0 - 4.1)
Surgical prophylaxis	96	7.0 (5.9 – 8.3)	79	110	5.3 (4.4 – 6.4)
Single dose	65	5.0 (4.1 – 6.1)	36	47	2.3 (0.1 - 4.4)
One day	20	1.3 (0.8 – 1.9)	30	39	1.9 (0 - 4)
>1 day	11	0.7 (0.4 – 1.3)	20	24	1.2 (0 - 3.3)
Medical prophylaxis	77	6.6 (5.6 – 7.9)	152	184	8.9 (6.8 - 11)
Other indication	34	3.0 (2.3 – 3.9)	9	9	0.4 (0 - 2.6)
Unknown/missing	31	2.9 (2.2 – 3.8)	25	29	1.4 (1.0 – 2.0)

Figure 7 Antimicrobial indication as a proportion of all antimicrobials prescribed



6.4. Antimicrobial use – Treatment

A total of 1,741 antimicrobials were prescribed for treatment of active infection, acquired either in hospital, community or long term care, accounting for 84.0% of all antimicrobials. These were used to treat 1,183 patients. The vast majority of antimicrobials for treatment (92.3%) were for five system infection groups, i.e. respiratory, skin& soft tissue/bone/joint, urinary tract, systemic and gastrointestinal infections. The most common diagnosis for treatment of active infection was respiratory tract infection; accounting for 35.2% of treatment intentions, see Table 28 and Appendix B Table V.

Table 28 Antimicrobial treatment, diagnosis site by indication

Site of infection	Treatment of infection – 2017		
	Diagnoses Number	Community infection Number	Hospital infection Number
Total	1,746	1,235	444
Respiratory tract	614	435	163
Skin/soft tissue/bone/joint	254	174	71
Urinary tract	201	158	31
Systemic infections	257	171	66
Gastro-intestinal system	288	208	77
Eye/ear/nose/throat	57	32	22
Central nervous system	31	24	6
Cardiovascular system	17	13	1
Genito-urinary system	27	20	7

6.4.1. Treatment of infection – Antimicrobial agents

Table 29 shows that twenty antimicrobials accounted for 90% of antimicrobials prescribed for treatment of infection (n=1,564). The antimicrobials prescribed for treatment of infection in patients surveyed. The most commonly prescribed antimicrobial for management of infection was piperacillin and enzyme inhibitor (piperacillin-tazobactam), accounting for 18.2%, marginally lower than the 20.4% recorded in 2012. Amoxicillin in combination with an enzyme inhibitor (co-amoxiclav) was the second most commonly prescribed antimicrobial for treatment of infection (9.6%, similar to the 10.8% reported in 2012); followed by amoxicillin (8.6%, unchanged from 8.1% in 2012).

Ciprofloxacin and clindamycin accounted for 3.8% and 1%, respectively, of antimicrobials prescribed for the treatment of infection, virtually unchanged since 2012. Cephalosporins accounted for 2.6% of all antimicrobials for treatment of infection, slightly higher than the 2.1% seen in 2012. A detailed breakdown of antimicrobial agents for treatment of infection is shown in Appendix B Table IV.

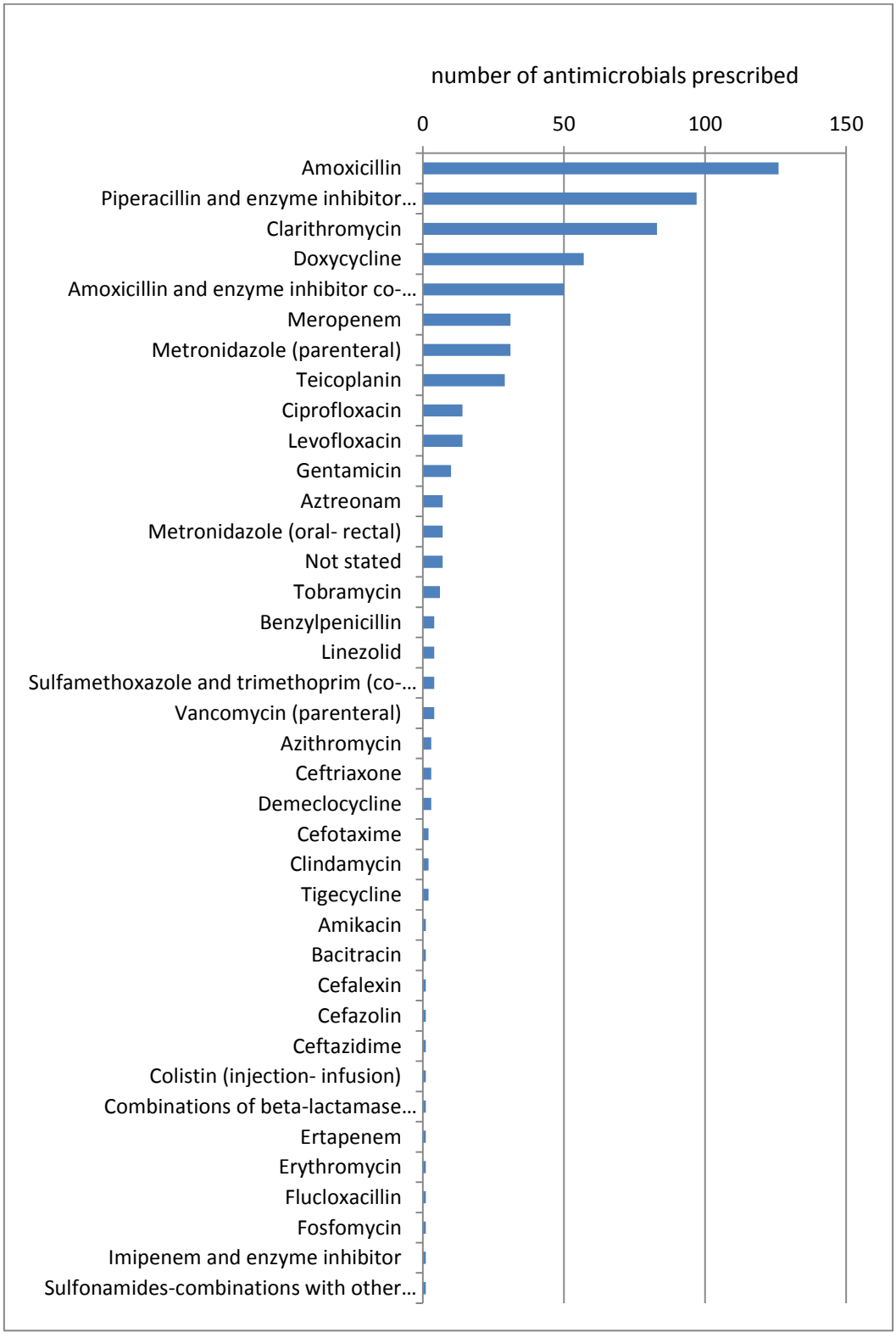
Table 29 – Antimicrobials for treatment of infection - 2017

Antimicrobial	Total number of antimicrobial agents for treatment	Proportion %
Total	1,741	100
Piperacillin and enzyme inhibitor	316	18.2
Amoxicillin	167	9.6
Amoxicillin and enzyme inhibitor	149	8.6
Gentamicin	115	6.6
Metronidazole (parenteral)	96	5.5
Clarithromycin	91	5.2
Teicoplanin	82	4.7
Flucloxacillin	80	4.6
Doxycycline	79	4.5
Meropenem	71	4.1
Ciprofloxacin	67	3.8
Metronidazole (oral- rectal)	45	2.6
Benzylpenicillin	43	2.5
Nystatin	34	2
Vancomycin (parenteral)	27	1.6
Ceftriaxone	25	1.4
Trimethoprim	24	1.4
Fluconazole	20	1.1
Clindamycin	17	1
Levofloxacin	16	0.9
Others	177	10.9

6.4.2. Treatment of respiratory infection – Antimicrobial agents

Figure 8 shows the distribution of antimicrobials prescribed for treatment of respiratory infections, i.e. pneumonia, acute bronchitis or exacerbations of chronic bronchitis (agents=39; prescriptions=614). Ten antimicrobials accounted for 86.7% of all antimicrobials prescribed for respiratory infections (prescriptions=614); the most common being amoxicillin, displacing piperacillin and enzyme inhibitor (piperacillin-tazobactam) since 2012 (prescriptions=126).

Figure 8 Antimicrobials prescribed for treatment of respiratory infections

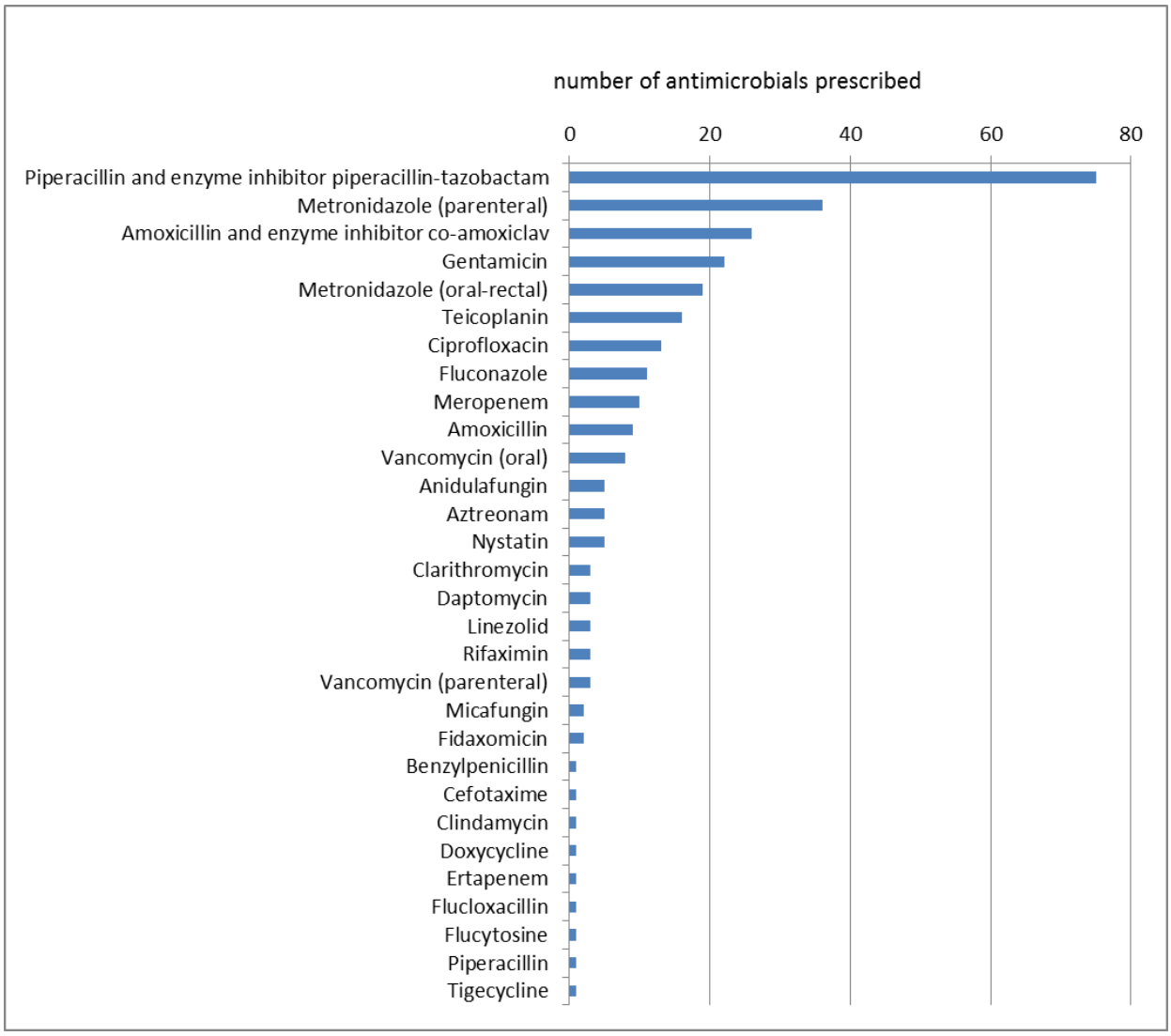


6.4.3. Treatment of gastrointestinal infections – Antimicrobial agents

Figure 9 illustrates the distribution of antimicrobials prescribed for treatment of gastrointestinal infections (agents=30; prescriptions=288). A total of 237 prescriptions were for treatment of intra-abdominal sepsis and 51 for treatment of gastroenteritis inclusive of *Clostridium difficile* infection. Three antimicrobials accounted for 47.6% of all antimicrobials prescribed in this category. As was the case in 2012, the most commonly prescribed antimicrobial

(prescriptions=75) was piperacillin and enzyme inhibitor (piperacillin-tazobactam) followed by metronidazole.

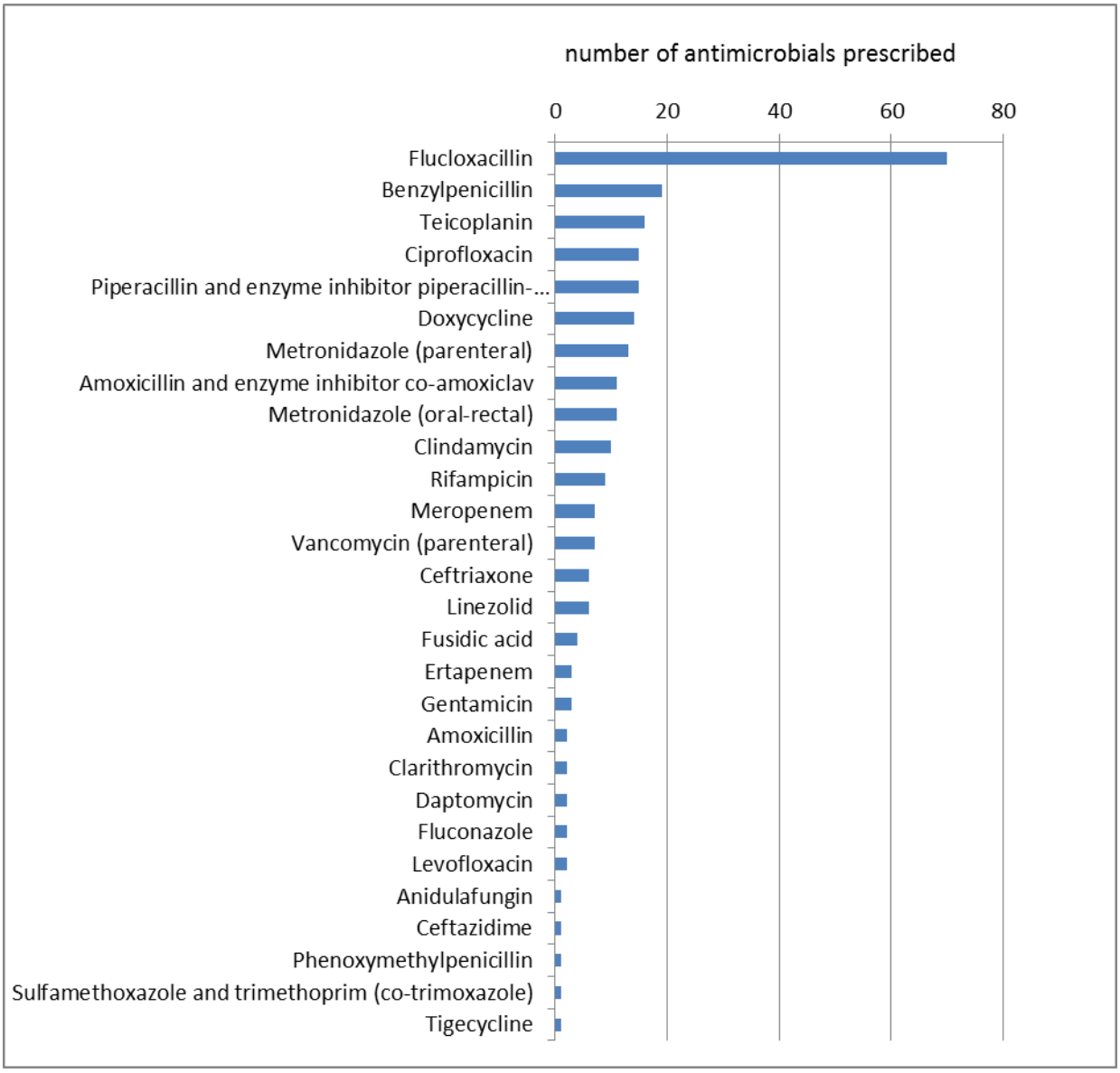
Figure 9 Antimicrobials prescribed for treatment of gastrointestinal infections



6.4.4. Treatment of skin & soft tissue/bone & joint infections – Antimicrobial agents

Figure 10 shows the distribution of antimicrobials prescribed for treatment of skin & soft tissue/bone & joint infections (agents= 28; prescriptions=254). Ten antimicrobials accounted for 76.3% of all antimicrobials prescribed in this category (prescriptions= 194). Since 2012, flucloxacillin remains the most commonly prescribed antimicrobial (prescriptions=70) accounting for 27.6% of all prescriptions.

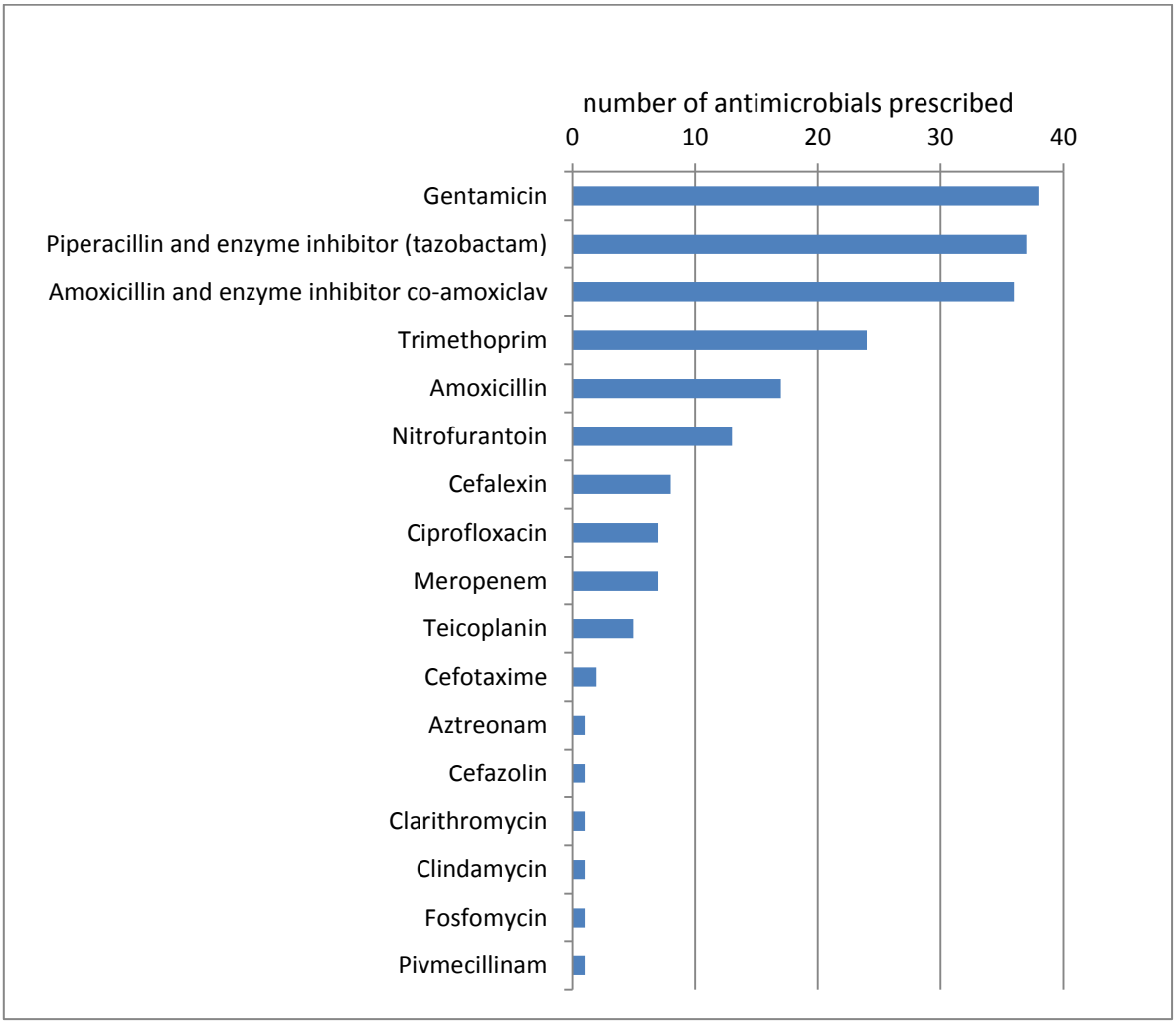
Figure 10 Antimicrobials prescribed for treatment of skin & soft tissue/bone & joint infections



6.4.5. Treatment of urinary tract infection (UTI) – Antimicrobial agents

Figure 11 shows the distribution of antimicrobials prescribed for the treatment of urinary tract infections (agents=18; prescriptions= 201). Five antimicrobials accounted for over 75% with gentamicin being the most commonly prescribed (prescriptions=38), closely followed by Piperacillin-Tazobactam.

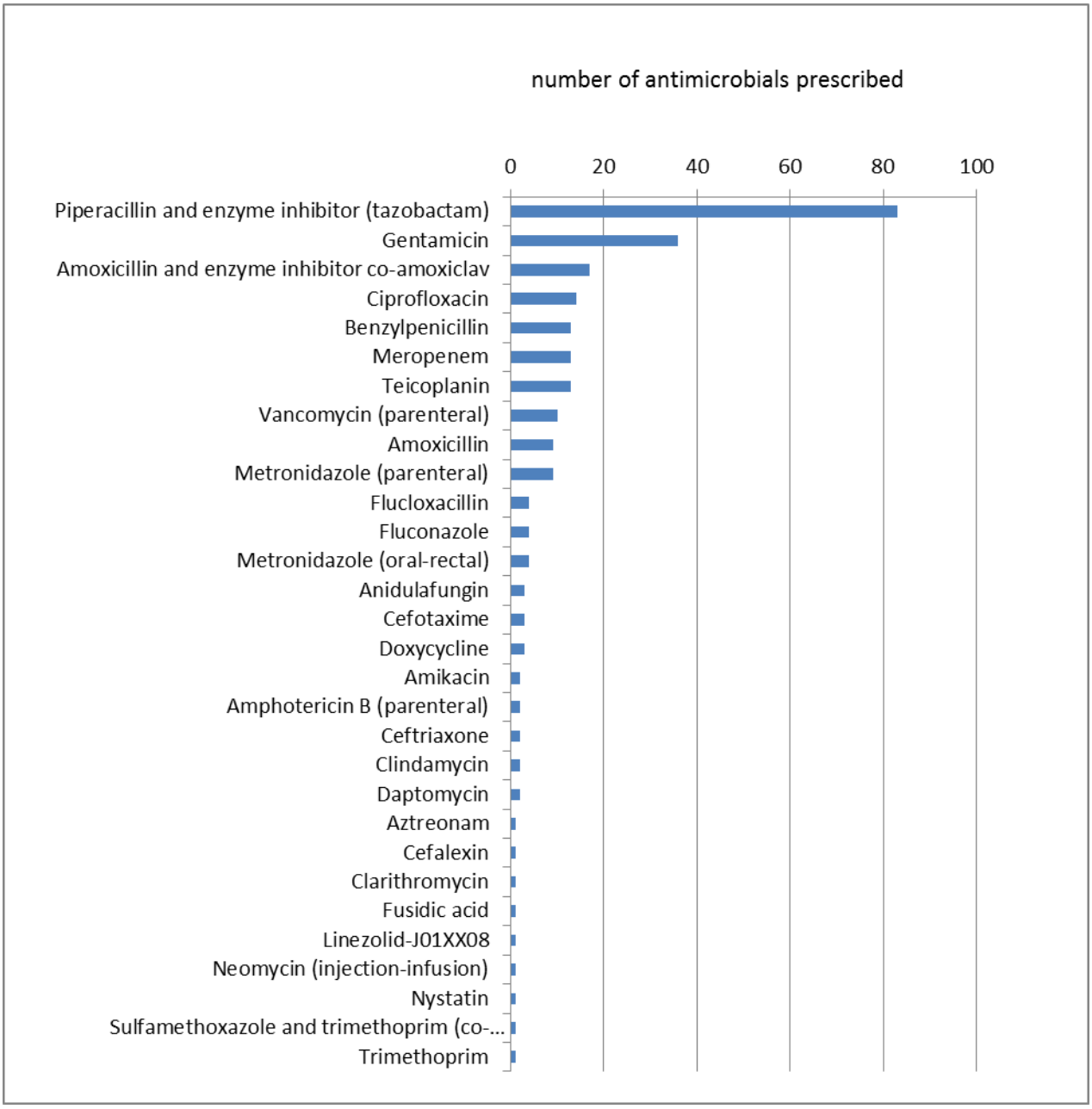
Figure 11 Antimicrobials prescribed for treatment of UTI



6.4.6. Treatment of systemic infection – Antimicrobial agents

Figure 12 shows the distribution of antimicrobials prescribed for treatment of systemic infections (agents= 30; prescriptions= 257). This diagnosis category included: laboratory-confirmed bacteraemia; clinical sepsis (suspected bloodstream infection without lab confirmation); febrile neutropenia or other manifestation of infection in an immunocompromised host; systemic inflammatory response with no clear anatomic site and undefined site with no systemic inflammation. Five antimicrobials accounted for 63.4% of antimicrobials prescribed in this diagnostic category (prescriptions=163). The most commonly prescribed antimicrobial for systemic infections (prescriptions=83) was piperacillin and enzyme inhibitor (piperacillin-tazobactam), remaining unchanged since 2012, and was over twice as likely to be prescribed as the next most frequently used antibiotic, gentamicin. Piperacillin-tazobactam and gentamicin accounted for 46.3% of antibiotics prescribed for systemic infection.

Figure 12 Antimicrobials prescribed for treatment of systemic infections



6.5. Antimicrobial use – Surgical prophylaxis

A total of 15 different antimicrobial agents were used for surgical prophylaxis; representing 110 prescriptions, i.e. 5.3% of all antimicrobials recorded (110/2073). The five most commonly used antimicrobials accounted for 83.6% of the total used for surgical prophylaxis. Cefuroxime was the most commonly prescribed agent in this category (23.6% of total), which was a move away from amoxicillin and enzyme inhibitor (co-amoxiclav) in 2012 - (Table 30). A detailed breakdown of antimicrobial agents for surgical prophylaxis is shown in Appendix B Table IV Overall, 23.3% of surgical prophylaxis was given for more than one-day.

Table 30 Surgical prophylaxis – Distribution of antimicrobials 2017

Antimicrobial name	Total number of antimicrobial agents	Proportion %
Total	110	100
Cefuroxime	26	23.6
Gentamicin	21	19.1
Amoxicillin and enzyme inhibitor co-amoxiclav	20	18.2
Flucloxacillin	14	12.7
Teicoplanin	11	10
Metronidazole (parenteral)	9	8.2
Amoxicillin	1	0.9
Clarithromycin	1	0.9
Clindamycin	1	0.9
Doxycycline	1	0.9
Fluconazole	1	0.9
Meropenem	1	0.9
Metronidazole (oral- rectal)	1	0.9
Piperacillin and enzyme inhibitor piperacillin-tazobactam	1	0.9
Not specified	1	0.9

6.6. Antimicrobial use – Medical prophylaxis

A total of 26 different antimicrobial agents were used for medical prophylaxis representing 184 prescriptions, i.e. 8.9% of all antimicrobials reported. The most prescribed antimicrobial for medical prophylaxis (27.7%) was sulfamethoxazole & trimethoprim (co-trimoxazole). Antifungal agents accounted for 20.6% of all medical prophylaxis, see Table 31. A detailed breakdown of antimicrobial agents for medical prophylaxis is shown in Appendix B Table IV.

Table 31 Medical prophylaxis – Distribution of antimicrobials 2017

Antimicrobial name	Total number of antimicrobial agents	Proportion %
Total	184	100%
Sulfamethoxazole and trimethoprim (co-trimoxazole)	51	27.7
Nystatin#	24	13
Azithromycin	16	8.7
Rifaximin	13	7.1
Cefalexin	12	6.5
Ciprofloxacin	7	3.8
Nitrofurantoin	7	3.8
Amoxicillin	6	3.3
Amphotericin B (parenteral)#	6	3.3
Doxycycline	6	3.3
Sulfonamides-combinations with other antibacterials (ex. trimethoprim)	6	3.3
Phenoxymethylpenicillin	4	2.2
Trimethoprim	4	2.2
Benzylpenicillin	3	1.6
Colistin (injection- infusion)	3	1.6
Gentamicin	3	1.6
Fluconazole#	2	1.1
Itraconazole#	2	1.1
Posaconazole#	2	1.1
Amoxicillin and enzyme inhibitor co-amoxiclav	1	0.5
Caspofungin#	1	0.5
Demeclocycline	1	0.5
Erythromycin	1	0.5
Voriconazole#	1	0.5
Piperacillin and enzyme inhibitor (Tazobactam)	1	0.5
Not specified	1	0.5
# antifungal agent		

6.7. Antimicrobial use by hospital type

The highest prevalence of antimicrobial prescribing was in ‘secondary’ level hospitals, with 39% of patients receiving antimicrobials, followed by ‘primary’ level hospitals with 38.5% of patients receiving antimicrobials (Table 32a), see Table 3 for hospital classification list.

There was a high degree of overlap in prevalence of antimicrobial use within hospital types, the only significant difference was in specialised hospitals, for example, antimicrobial use was higher in a children’s hospital compared to an orthopaedic hospital (Figure 13).

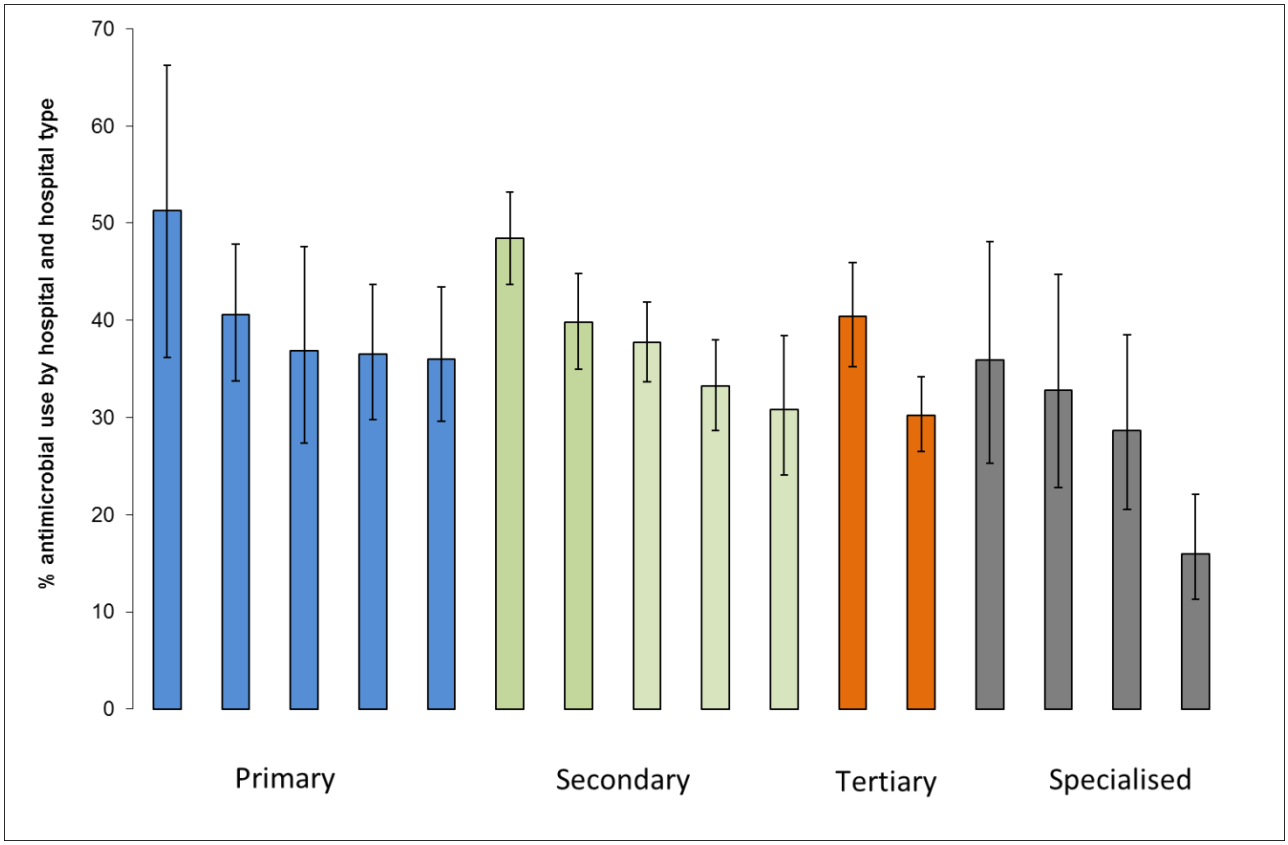
Table 32a Prevalence of antimicrobial use by hospital type

Hospital type	2012	2017		
	AMU prevalence % (95%CI)	Number of patients	Number of patients receiving AM	AMU prevalence % (95%CI)
Primary	31.5 (28.1 – 35.2)	663	255	38.5 (34.8 – 42.2)
Secondary	28.4 (26.4 – 30.4)	1892	738	39.0 (36.8 – 41.2)
Tertiary	32.9 (30.0 – 35.9)	858	292	34.0 (30.9 – 37.3)
Specialised	23.8 (19.9 – 28.0)	400	100	25.0 (21.0 – 29.5)

Table 32b Total volume of antimicrobials prescribed by hospital type

Hospital type	2017 Number of patients	2017 Number of prescriptions	Number of scripts per 100 patients
Total	3813	2073	54.37
Primary	663	361	54.45
Secondary	1892	1136	60.04
Tertiary	858	440	51.28
Specialised	400	136	34.00

Figure 13 Antimicrobial use prevalence for individual hospital by hospital type



6.8. Antimicrobial use by ward specialty

The highest prevalence of antimicrobial prescribing was in adult ICU, where 64.9% of patients received antimicrobials, an increase of almost ten percentage points since 2012 (Table 33). This was followed by mixed specialty wards and medical wards, where 50.8% and 40.6% of patients respectively received antimicrobials. The lowest prevalence of antimicrobial use was in Rehabilitation (7.5%).

Table 33 Prevalence of antimicrobial use by ward specialty 2017

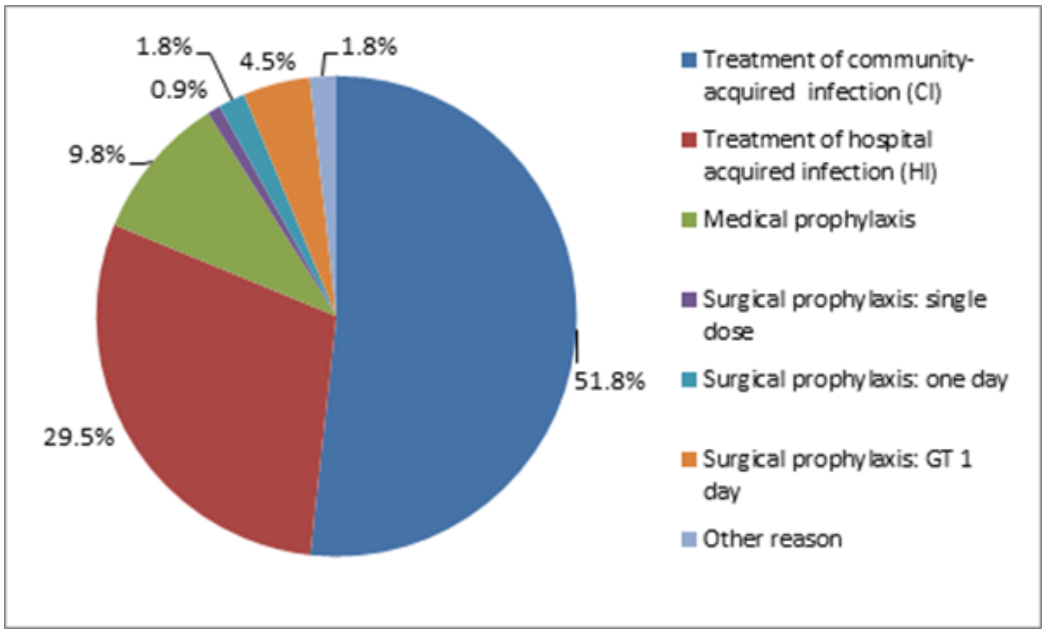
Ward specialty	Number of patients	Number receiving antimicrobials	Antimicrobial use prevalence percent (95%CI)
All specialties	3,813	1,385	36.3 (34.7 - 37.9)
Care of the elderly	371	125	33.7 (28.9 - 38.8)
Adult ICU	74	48	64.9 (52.9 - 75.6)
Medical	1597	649	40.6 (38.2 - 43.1)
Obstetrics/Gynae	329	69	21.0 (16.7 - 25.8)
Paediatrics	227	71	31.3 (25.6 - 37.6)
Surgical	988	331	33.5 (30.6 - 36.5)
Mixed specialty	132	67	50.8 (41.9 – 59.6)
Rehabilitation	40	3	7.5 (1.6 - 20.4)
Other	55	22	40.0 (27 - 54.1)

6.9. Antimicrobial use for paediatric patients

Paediatric patients were defined as those aged less than 16 years, whether found on an adult or paediatric ward. There were 326 paediatric patients and 80 (24.5%) (95%CI 20.2 – 29.5) were receiving antimicrobials. Neonates, on postnatal wards (n=84) 'well babies', had a low AMU prevalence (7.1%). The AMU prevalence in paediatric patients (0-15 years), excluding 'well babies', was 30.8% (95%CI 25.3 – 36.9).

Over eight in ten (80.5%) of antimicrobials administered to patients under 16-year old was for treatment of infection, Figure 14. The most common reason for antimicrobial prescribing in paediatrics was for infections reported as community acquired – 51.3%, followed by a hospital associated infection (29.2%). Surgical prophylaxis and medical prophylaxis accounted for 7.1% and 9.7% of all antimicrobials respectively.

Figure 14 Antimicrobial indication for paediatric patients



6.10. Antimicrobial use – Appropriateness of prescribing

All Health and Social Care Trusts in Northern Ireland have developed local guidelines addressing best practice for antimicrobial use in the hospital setting. Each prescription recorded during the survey was assessed as compliant or non-compliant with local guidelines. During the survey, 11.7% of all antimicrobials were noted as non-compliant with local guidelines and 14.4% were recorded as 'not assessable', i.e. antimicrobial administered for medical prophylaxis, or administered for treatment of infection in absence of local prescribing guideline, or antimicrobials administered for surgical prophylaxis in absence of local prescribing guideline, see Figure 15. Over a quarter (50/176; 28.4%) of amoxicillin and enzyme inhibitor (co-amoxiclav) prescriptions did not meet local prescribing guidelines, (Table 34)

Figure 15 Antimicrobials - Compliant with local guideline

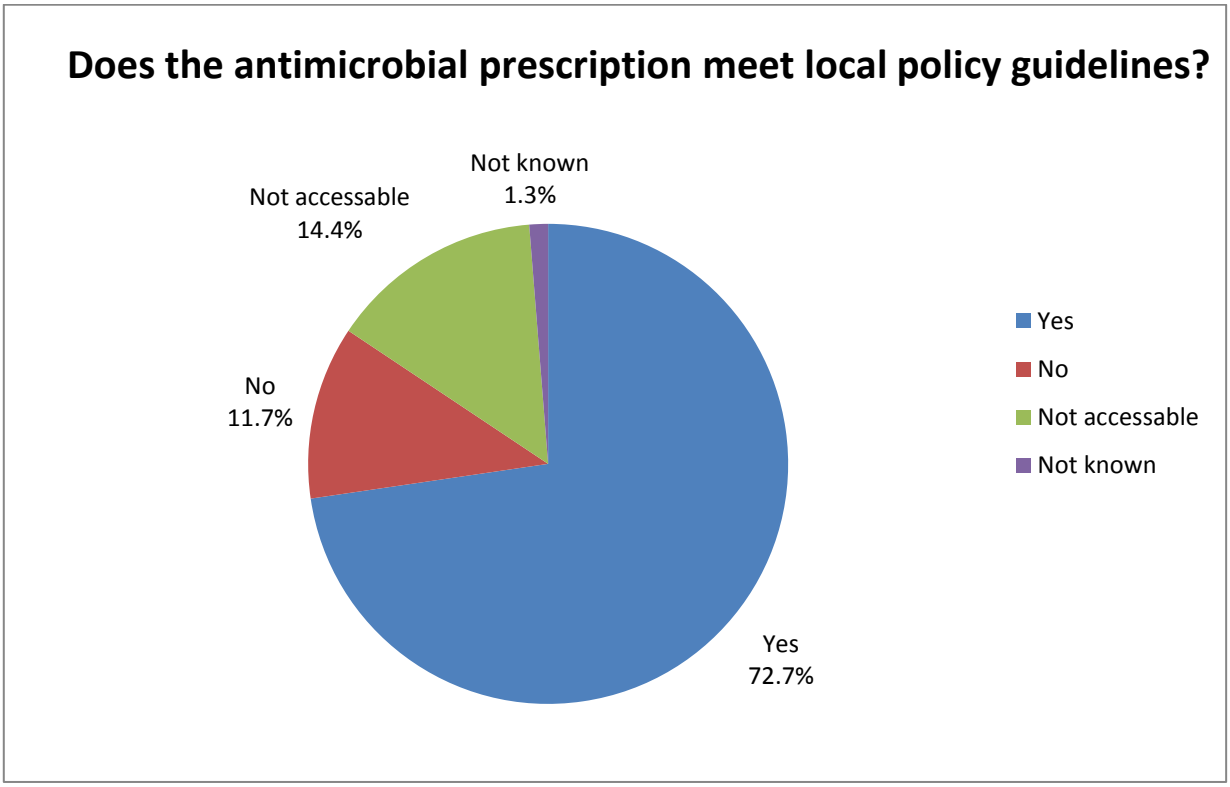


Table 34 Antimicrobials – Non-compliant antimicrobials (Top 10 named) 2017

Antimicrobial	Total antimicrobials	Number non-compliant	% non-compliant
Total	2073	241	11.6
Amoxicillin and enzyme inhibitor (co-amoxiclav)	176	50	28.4
Piperacillin and enzyme inhibitor (Pip Taz)	322	50	15.5
Amoxicillin	177	20	11.3
Clarithromycin	92	16	17.4
Metronidazole (parenteral)	105	15	14.3
Doxycycline	87	9	10.3
Gentamicin	139	9	6.5
Teicoplanin	93	9	9.7
Meropenem	75	8	10.7
Metronidazole (oral-rectal)	48	8	16.7
Other antimicrobials (agents = 22)	759	47	6.2

7. Infection, prevention and control and antimicrobial stewardship indicators

A summary of Infection prevention and control, antimicrobial stewardship structures and process indicator data are provided in Table 35. Hospital process and indicator data were collected for all participating hospitals. Data obtained at the time of the survey at the ward level were summed for each hospital. In wards where data were missing, their information was excluded from indicator calculations. Due to limited time and resource in collating and checking the indicator information, results should be treated with caution and will not be discussed further in the discussion section of the report.

Average length of stay in hospital was calculated by dividing the total number of bed days for the hospital by the total number of discharges. This figure represents the average length of stay for a patient from admission to a ward until discharge or transfer to another hospital. At the time of the last PPS in 2012 it was estimated that average length of stay across all hospital sites was 4.69, but this had reduced slightly to 4.49 days in 2017.

All of the hospitals had annual IPC plans and had produced an IPC report. There were approximately 2.3 IPCNs and 0.4 Infection Control doctors (ICD) per 250 beds. There were approximately 0.5 Whole Time Equivalent (WTE) staff with an antimicrobial stewardship role per 250 beds. One hospital reported a formal process to review the appropriateness of an antimicrobial order within 72 hours in all wards and a further 13 reported a review in a select group of wards (four hospitals indicated that this applied to ICU).

Table 35 Summary of infection prevention and control and antimicrobial stewardship structure and process indicator data in Northern Ireland 2017

	Indicator	Northern Ireland aggregate
Activity and bed occupancy	Number of discharges	296902
	Number of patient days	1333740
	Average length of stay	4.49
	Number acute beds	4331
Staffing	WTE nurses	9466.48
	WTE nurses/100 beds	218.57
	WTE nurse assistants	5400.97
	WTE nurse assistants/100 beds	124.70
	WTE infection control doctors	6.85
	WTE infection control doctors/250 beds	0.40
	WTE infection control nurses	39.79
	WTE infection control nurses/250 beds	2.30

	Indicator	Northern Ireland aggregate
Characteristics of IPC programmes	Availability of microbiology service on Saturdays, clinical samples	100% (16/16)
	Availability of microbiology service on Saturdays, screening samples	100% (16/16)
	Availability of microbiology service on Sundays, clinical samples	100% (16/16)
	Availability of microbiology service on Sundays, screening samples	100% (16/16)
	Number of blood culture sets received and incubated per 1000 patient days	58.43
	Number of in-patient stool tests performed for *Clostridium difficile* infection per 1000 patient days	11.44
Isolation capacity	Total number of single rooms in surveyed wards	1378
	Percentage of all beds in surveyed wards that were single rooms	31.82
	Total number single rooms with ensuite facilities	1130
	Percentage of single rooms that had ensuite facilities	82.0
Hand hygiene and availability of Alcohol Based Hand Rub (ABHR)	Total alcohol hand rub consumption (litres)	41493
	Total alcohol hand rub consumption per 1000 patient days	31.11
	Total number of observed hand hygiene opportunities in year	93652
Characteristics of antimicrobial stewardship programmes	Formal process to review the appropriateness of an antimicrobial within 72 hours of initial order	One hospital indicated 'yes to all wards', 13 hospitals indicated 'yes to selected wards only', 2 hospitals reported 'no review on any wards'

8. Discussion

This report presents the results of the 2017 point prevalence survey (PPS) of hospital – acquired infection (HAI) and antimicrobial use (AMU) in acute hospitals in Northern Ireland. The majority of face-to-face training sessions were undertaken in May 2017 and fieldwork was completed in June. The survey included 3,813 eligible patients in all 16 acute hospitals. Information was collected for patients in 89% of available acute beds; the remaining 11% of beds were not included either because the beds were not occupied or the patients were not eligible for inclusion in the survey, e.g. admitted after 8am or transferred to another ward after 8am on the day of the survey. The objectives of the survey were to determine the burden of HAI and AMU and to identify priorities areas for the future. Involvement in this PPS was on a voluntary basis, however, as in the previous PPS in 2012, all acute Health and Social Care Trusts participated, thus providing a robust data series for analysis and comparison in Northern Ireland.

This is the fifth time a point prevalence survey of healthcare associated infection (HAI) has been undertaken in Northern Ireland since 1994. Whilst there have been some changes to the definitions used for surveillance in the different years in which surveys have been completed, there has been greater consistency since 2012, meaning that comparisons between 2012 and 2017 have greater validity. This report has been presented to examine comparisons and contrasts between 2012 and 2017 so that a better insight into the pattern of infections and antimicrobial use affecting patients can be obtained.

8.1. Overall trends

The overall rate of healthcare associated infection in 2006 was 5.4% and this dropped to 4.2% in 2012. In 2017, the headline rate has increased to 6.1% (95% CI 5.4-6.9). As the definitions used have remained fairly static between 2012 and 2017, this increase in the overall infection rate is indicative of a rise in the proportion of patients who develop an HAI.

The proportion of inpatients in receipt of one or more antimicrobials in 2012 was 29.5% and the comparable figure for 2017 was higher at 36.3% (95% CI 34.8-37.9). This represents an increase in the prevalence of patients receiving antimicrobials.

The sample of eligible patients in 2017 was identical to that in 2012 except for those patients who were on acute psychiatric wards, who were excluded in 2017. To compare the overall HAI rate between 2012 and 2017, inpatients in acute psychiatric wards were removed from the sample in 2012 and the overall HAI rate was re-calculated. This change only increased the HAI rate by 0.1 percentage point, from 4.2% to 4.3% (95% CI 3.7-5.0). Removing acute psychiatry from those who received antimicrobials increased prevalence by 1.4 percentage points, from 29.5% to 30.9% (95% CI 29.4-32.4).

8.2. Changes to the composition of the inpatient population

In common with other parts of the UK, changes to demographic characteristics have influenced the patient population. The average age of inpatients has increased (median age increase from 66 to 68 years) and a higher proportion has multiple co-morbidities (increased proportion with

end of life prognosis, from 2.9% to 5.4%), which may have impacted on the number of inpatients who develop a healthcare associated infection. In order to assess if an older and more dependent patient population has led to an increase in the HAI rate, the sample was re-weighted to account for these changes. When the weights were applied to the 2017 data there was virtually no change to the HAI rate, in terms of the re-adjusted age distribution. The number of patients with an HAI remained the same at 6.1%, but there was a slight reduction in the AMU prevalence where the number of patients on antimicrobials reduced by 10 to 1,375 (36.1%) a small and non-significant reduction from 36.3%.

In terms of weights for the disease prognosis, when the sample was reweighted, the number of patients with an HAI dropped by just one to 233 and the headline rate remained at 6.1%. In terms of AM prevalence the number increased to 1,397 (36.7%) a small increase of 0.4%.

It would appear that the increase in HAI and AM prevalence in the acute PPS in 2017 is not driven by a change in the age distribution or disease prognosis of the patient population. This is an interesting finding taking into consideration the increasing susceptibility to infection of older and sicker patients. Further analysis of these increases showed that, rather than all hospital types registering a larger share of patients with HAI or in receipt of antimicrobials, the increases were concentrated in 'secondary' type hospitals and to a lesser extent in 'primary' type hospitals. There are multiple possible explanations for this change, which may reflect increasingly sick and dependent patients in these types of hospitals as well as increasing demand for services and patient turnover.

8.3. Validation study

In 2017 a comprehensive external validation was undertaken (blind and in parallel) alongside the internal data collection team at each hospital. No such validation survey took place in 2012. Approximately 520 inpatients were validated, or 14% of the total sample of 3,813 patients. While this showed a high level of consistency (with specificity for HAI at 98.6% and sensitivity at 86.1%, the comparable specificity for antimicrobial use was 98.4% and the sensitivity was 98.7%), it also revealed some false positives and false negatives. The validation study was used to produce an adjusted prevalence figure for Northern Ireland for both HAI and AMU. The adjusted HAI rate was 0.3 percentage points lower at 5.8% (95% CI 4.1-7.8). There was less impact on the overall prevalence of antimicrobial use which remained at 36.3% (95%CI 34.8-38.0). The PPS validation study supports the finding of the main PPS study for both HCAI and AMU.

8.4. HAI prevalence

Until relatively recently the proportion of HAI considered preventable was estimated to be 25 – 40% (23). More recent research suggests that up to 70% of all healthcare-associated infections are preventable using current evidence-based strategies (24).

The dynamic nature of healthcare delivery, the changing nature of the acute care population, adaptation of microorganisms, as well as the changing pattern of interventions are important factors influencing the prevalence of HAI and antimicrobial use. As it is not possible to maintain incidence surveillance across all specialist areas, consideration needs to be given to particular service areas and/or microorganisms for targeted surveillance. Previously it has been

determined that areas of high risk, high volume and high cost benefit most from HAI surveillance (25).

Findings arising from this PPS provide an opportunity to review changes in the epidemiology and burden of HAI and AMU in Northern Ireland. The changes highlighted will inform the development of policy and interventions aimed at reducing risk of infection, augmenting antimicrobial stewardship and targeting incidence surveillance programmes.

The overall prevalence of HAI in acute care in Northern Ireland hospitals surveyed was 6.1% (95%CI 5.4 – 6.9). This rate represents an increase in the prevalence since 2012, and also is higher than some other UK countries who have reported their 2017 results e.g. Scotland where the prevalence is 4.5% (95% CI 4.0-5.0) and Wales (5.5%; 95%CI 5.0-6.1) (1) (2) (4) (3) (5).

HAI prevalence in PPS 2017 was higher than that reported in PPS 2012. Following appropriate adjustments, HAI prevalence in PPS 2017 was approximately 1.5 percentage points higher than in PPS 2012. This finding is reflective of trends reported for HAI by incidence surveillance programmes across different countries (26) (27).

8.4.1. HAI prevalence – Population profile

In PPS 2006, a linear relationship between age and HAI prevalence was reported (11). This relationship was not observed for 2012 or 2017. In the adult population, the highest HAI prevalence occurred in 65-79 year old age group (7.6%), whereas in PPS 2012, the highest HAI prevalence occurred in 50-64 group (5.8%).

A number of demographic changes were seen between comparable survey populations in PPS 2017 and PPS 2012. In particular, the proportion of adult patients aged over 65 years was higher in 2017 compared to 2012 (56% compared to 52%). The proportion of patients recorded in Care of the Elderly was also higher in 2017 (9.7%) than in 2012 (7.1%). This suggests that older patients represent a larger proportion of inpatients in this survey compared to the previous PPS.

HAI prevalence in all hospital specialties increased. Between 2012 and 2017, the increases were greatest in Adult ICU (9.1% versus 17.6%); Care of the Elderly (5.7% versus 7.5%) and paediatrics (4.5% versus 7.0%). In 2017, analysis of wards which had ‘mixed’ specialty of inpatients also had an above average proportion of HAI at 7.6%. A renewed focus to target infection prevention and control activities in high prevalence wards is required in order to reduce HAI and specific attention is required to address the specific issue of complex patient needs in mixed specialty wards.

HAI was most frequently observed in the adult ICU setting with approximately 18% of patients being recorded with an HAI. This finding is in keeping with PPS findings reported in other UK administrations (1) (2) (4) (3) (5). ICU patients generally have more complex needs and greater susceptibility to infection as they often require many devices and antimicrobials to support delivery of care. The ICU population may also continue to have higher risks for infection when discharged to general wards, which may be related to on-going device use.

Device-associated incidence surveillance was introduced as a mandatory programme across critical care units in Northern Ireland during 2010, capturing three main categories of device-associated HAI. 'Wardwatcher' software is used in most units and the process of data collection, analysis and reporting has been simplified and streamlined. The proportion of ventilator associated pneumonia, catheter associated urinary tract infections and central line associated blood stream infections are measured per 1,000 device days. In December 2017 the relevant rates were 0.60, 0.10 and 0.41 infections per 1,000 device days respectively. While these rates may indicate the application of high standards, the rates are perhaps lower than what might be expected given data from other parts of the UK. A review of the impact of this surveillance programme is planned, to ensure that units are adhering to protocol and data are being recorded accurately.

The prevalence of HAI in the paediatric and child population (aged 0-15 years) in PPS 2012 was 3.4% (95%CI 2.0 – 5.7) and was 5.5% in 2017 (95% CI 3.5-8.6). Overall HAI prevalence in the paediatric population was reduced by the 'well baby' cohort – well babies nursed on postnatal wards with a short length of stay had a lower HAI prevalence at 2.3%.

8.4.2. HAI prevalence – Hospital type

In 2012 HAI prevalence was significantly higher in tertiary hospitals (6.8%) compared with the overall average, but in 2017 the difference between hospital types was considerably reduced – the rate for tertiary hospitals was 6.9%, followed by secondary hospitals 6.2%, specialised units 5.8% and primary hospitals 5.1%. This finding may represent a more complex case mix in hospitals below tertiary level, as well as greater specialisation of services being delivered. A detailed set of results has been issued to each hospital and discussions are ongoing about priorities for action in relation to infection reduction and antimicrobial stewardship. The results of this survey have also been used to help inform a regional strategy and action plan to reduce antimicrobial consumption (28).

8.4.3. HAI prevalence – Number and classification of infections

Overall, 234 patients were identified as having an active HAI in PPS 2017, only seven patients were identified with two HAIs. The most common types of HAI were: pneumonia (29.0%), followed by SSI (17.0%), gastrointestinal (10.4%), BSI (8.7%), eye/ENT or oral (6.6%), UTI (6.2%) and systemic infection - specifically clinical sepsis (6.2%). The overall pattern was similar to 2012, when pneumonia and SSI were the modal infections. In 2017, the proportion of UTI infections dropped compared with 2012, from 11.8% to 6.2%; and 2017 saw an increase in eye/ENT and oral infections compared with 2012, up from 1.2% to 6.6%.

Across the rest of the UK, the modal infections are: pneumonia, SSI and UTI. The drop in the proportion of UTIs in Northern Ireland contrasts with the situation elsewhere, for example, in the PPS in Scotland in 2017, the proportion of UTI infections was 24.5%. Feedback from infection control teams in local Trusts has outlined the preventative work they have undertaken in relation to the urinary catheter bundle across hospitals in Northern Ireland, and it would seem that this approach has avoided deterioration in infection rates for UTIs.

The majority of HAI (77.2%) identified during PPS 2017 developed during a patient's stay in the admitting hospital. Of those present on admission (n=55), just over half of the infections related

to the same hospital with the others relating to a stay in a different hospital or another healthcare environment.

For HAI not present at admission, approximately four in ten HAI (40.9%) were identified within the first seven days following admission. The majority of HAI (59.1%) were identified more than one week following admission to hospital, and 18.8 % of all HAIs were reported more than three weeks after admission.

8.4.4. HAI Prevalence – Devices in situ

Invasive devices were most prevalent in adult ICU, and across all specialties over six in ten (60.3%) inpatients (95% CI 58.7 – 61.8) had an invasive device *in situ* at the time of survey. This represented an increase from 2012 when the overall proportion was 51%. Peripheral vascular catheter (PVC), either arterial or venous, was the most common device present for over half (52.8%) of patients. The proportion of patients with a peripheral catheter was greater in Northern Ireland compared with other parts of the UK, where the comparable prevalence of peripheral catheter use was e.g. 36.3% in Scotland in PPS 2017 (3), 35.8% in Wales for acute patients in their 2017 PPS (5) and 38.6% in England in the PPS 2012. Infection prevention and control teams need to encourage appropriate use and review of peripheral catheters and attention could be focused on developing resources that can be used by clinical and ward staff for monitoring peripheral lines that are in place ensuring that these are regularly reviewed.

Urinary catheters were present for 17.8% of patients (95% CI 16.6 – 19.1) which was similar to the rate observed in 2012 (17.1%). It would seem that this rate is slightly lower than that observed in Scotland and slightly lower than that observed for acute patients in the 2017 PPS in Wales (19.2%). Ensuring consistent use of the catheter bundle is an essential component of avoiding UTIs. This requires an ongoing drive by infection prevention and control colleagues and ward staff with regular monitoring and feedback to ensure standards are maintained.

Pneumonia and lower respiratory tract infection

The prevalence of pneumonia in patients in 2012 was 1.0% (95% CI 0.8 - 1.4) and in 2017 had increased to 1.8% (95% CI 1.5 - 2.3) which is a significant rise. Hospital associated pneumonia is estimated to increase a hospital stay by about eight days and has a reported mortality rate ranging from 30–70%. There are variations in clinical management and outcomes across different parts of the UK (29).

The vast majority of pneumonias were clinically defined in both 2012 and 2017 (97% and 98% respectively) and microbiological confirmation of pneumonia was recorded for a small proportion of pneumonias in both surveys. The proportion of pneumonias which were assessed as ventilator associated (VAP) was 10.0% (7 out of 70). While the collection of surveillance data on ventilator and non-ventilator associated pneumonia is good in the context of ICU, there appears to be a gap in reporting of non-ventilator associated pneumonia in specialties other than ICU.

Respiratory tract infections (pneumonia and LRTI) were the most frequent HAI detected in PPS 2012 and 2017. As the proportion has increased in 2017, development of a protocol, checklist and monitoring system for pneumonia for patients in acute surgical and medical wards should be

a priority. Attention should be focused on implementation of a tool for possible intervention for specialties where there appears to be a heightened risk of pneumonia, such as general medicine and general surgery. Research indicates that a number of interventions have a positive impact on prevention of pneumonia, such as: hand hygiene, oral care with antiseptic, aspiration prevention, bed elevation and early mobilisation.

Surgical Site Infection (SSI)

The second most frequent HAI detected in this PPS was SSI. PHA currently oversees mandatory surveillance of surgical site infections following orthopaedic procedures, neurosurgery, cardiac surgery and caesarean section delivery. Deep incisional and organ/space SSI cause the greatest morbidity and mortality and accounted for almost three quarters (73%) of all SSIs recorded. Superficial site infections are less likely to result in death or injury and their identification may present challenges in terms of standardisation across hospitals.

A small but increasing burden of SSI was noted from 0.8% in 2012 (95% CI 0.6 – 1.1) to 1.1% in 2017 (95%CI 0.8–1.5). While the number of superficial incisional infections and deep incisional infections was similar between both surveys, the number of organ/space SSI more than doubled (n=8 in 2012, n=20 in 2017). This may indicate that SSI in the acute setting has increased because of the procedures being conducted and patient characteristics. The evolving nature of surgical intervention, advances in technology and changes to practice facilitate delivery of more complex care. This finding is likely to have significant implications for patients' quality of life and the future cost of healthcare delivery.

It is important to note that point prevalence surveys will only include SSI present in the hospital inpatient population. A number of factors are likely to impact on the proportion of SSI identified in the acute care setting, including higher patient turn-over and earlier discharge of patients who have undergone surgical procedure(s). These factors increase the likelihood that SSI will be seen and managed with increasing frequency in the post-acute setting, thus the current PHA incidence surveillance must include post-discharge follow-up. As a result, the SSI captured by this survey are likely to be an underestimation of the total burden of SSIs.

One quarter of SSIs (26.8%) reported in PPS 2017 were identified following general surgical procedures, followed by orthopaedics (19.5%) and obstetrics and gynaecology (17.1%). The incidence surveillance systems in place in Northern Ireland include: orthopaedic surveillance, caesarean section surveillance, cardiac and neurosurgery. Following the last PPS, a decision was made to take forward a pilot into surgical site infections following breast surgery, this programme has been ongoing for a year in one Trust and a review of the data collected is planned in order to assess if there is merit in rolling the programme out to other Trusts.

An increase in the rate of SSI observed in this PPS, when set against a reducing trend in the incidence programme of surveillance following orthopaedic surgery, suggests that the incidence survey is under reporting the true level of SSI. The incidence of SSI following orthopaedic surgery has significantly reduced since the introduction of mandatory orthopaedic SSI incidence surveillance in Northern Ireland. This reduction has been maintained between 2012 and 2017, with orthopaedic SSI rates currently standing at 0.28% (2017) (27). In 2014

PHA refreshed training on detection of SSI, and introduced light surveillance in a number of areas, so that the burden of completing forms for all procedures was removed. The impact of this change may mean that awareness about the surveillance has declined, so it is recommended that refresher training should take place and trusts should be notified about raising awareness so that reported rates of SSI are an accurate reflection of the total burden of SSI infections (30).

Two SSIs following caesarean section delivery were reported in PPS 2017 (survey included hospital in-patients only) one of these was a readmission and one was diagnosed on the ward following surgery. Currently mandatory incidence surveillance indicates that 90% of post-caesarean section SSI occurs following discharge from acute hospital care (31). It was therefore not unexpected that given the short length of stay for obstetric patients, few SSI were recorded following caesarean section in PPS 2017. Currently, the methodology used for caesarean section surveillance still relies on paper forms being completed on the ward and then following women once they are discharged into the community. Given that this approach is labour intensive, a scoping study is planned to investigate how administrative data might be adopted for use in providing a denominator for these procedures. This will allow for a more timely and efficient use of resources at the front line with emphasis on identifying SSIs which develop in the community, post discharge.

Urinary tracts infection (UTI)

While the proportion of symptomatic UTI in 2017 was half of that observed in 2012 (6% versus 12%), the prevalence showed a small downward shift from 0.5% in 2012 to 0.39% in 2017. Given a rising tide of other healthcare associated infections, the fact that an increase was not observed for UTIs is welcome.

Indications are that this is in contrast to the position in other parts of the UK, where UTI remains in the top three infections. In Northern Ireland it was ranked fifth after pneumonia, SSI, gastrointestinal and bloodstream infection. The proportion of patients with a urinary catheter in-situ at the time of the survey was broadly similar between both surveys (17.1% in 2012; 17.8% in 2017) as was the percentage of UTIs deemed catheter-related (35% in 2012; 33% in 2017). This finding suggests that ongoing vigilance in applying good catheter management remains a key component of achieving further improvement in UTI rates. Feedback from local trusts has re-confirmed the time and effort that has gone into training staff in the use of catheter bundles and its impact on avoiding infection.

Systemic infection

A new definition of clinical sepsis in adults and children was added to the systemic infection HAI group in 2012. This definition allowed data to be gathered, from both paediatric and adult populations, where there was clinical evidence of infection without positive microbiology confirmation.

In 2012, systemic infections (in effect clinical sepsis) accounted for 11.8% of all HAI. In 2017, the proportion of systemic infections was 6.2%, the majority of infections being clinical sepsis (n=13). Two were coded as a disseminated infection, involving multiple organs or systems but

without an apparent single site of infection. Early identification of sepsis is required in order to avoid potentially life threatening or life altering conditions. The Sepsis Six care bundle, when taken as a whole, has been shown to reduce the relative risk of death by almost half. More work needs to go into implementing the bundle in the acute setting and in raising awareness amongst staff for those patients who are at most risk (32).

Bloodstream infection (BSI)

The proportion of inpatients with a bloodstream infection in 2012 was 0.4% (95% CI, 0.2-0.7), whilst in 2017 the comparable proportion was 0.6% (95%CI, 0.4 – 0.9).

The survey confirms a general decline in the incidence of MRSA as the causative organism in bloodstream infections, with two out of eighteen infections being caused by MRSA (26).

Gastrointestinal infection

Prevalence of gastrointestinal infections increased slightly between 2012 when it was 0.4% (95% CI, 0.2 - 0.6) to 2017 when it was 0.7% (95% CI, 0.4 - 1.0) (26). The proportion of gastrointestinal infections where *Clostridium difficile* was diagnosed was just over half (n=14) in 2017, with an overall prevalence of 0.37 (95% CI, 0.2 - 0.6). This highlights the importance of focusing on infection prevention and control practices in reducing *Clostridium difficile* rates in acute settings.

Eye, ENT or mouth infection

Prevalence of infections of the eye, ENT or mouth increased from just 2 in 2012 to 16 infections in 2017. While the numbers are small, it is a significant increase in the prevalence of this type of infection to 0.4% (95%CI, 0.3-0.7). An investigation into these infections found that they were all oral cavity infections and the majority of patients (n=9) were aged over 79 years.

8.4.5. Summary of HAI priorities

1. Explore feasibility for scoping and implementing a project aimed at reducing the burden of non-ventilator associated pneumonia.
2. Continued emphasis on education and training of clinical staff on methods for improvement and prevention of HAI, with particular emphasis on learning tools for prevention of healthcare associated pneumonia and LRTI.
3. Consideration should be given to the development of methodologies to support standardised incidence surveillance of respiratory tract infections and clinical sepsis most commonly reported in the hospital context.
4. Continue to promote evidence based practice to reduce surgical site infection across surgical specialties (WHO bundle compliance, application of NICE and CDC guidelines as well as other relevant guidance).
5. Given an increased rate of surgical site infection observed in this survey, a review and validation of the case ascertainment and reporting arrangements in the current SSI surveillance programmes (caesarean section, orthopaedic, cardiac and neurosurgery) is recommended.

6. The future SSI surveillance arrangements should consider the need for improved methodology for the SSI incidence surveillance programme with a view to developing more efficient systems for data collection.
7. The requirement for potential extension of the SSI surveillance programme into other speciality/procedure areas should be taken forward in collaboration with relevant stakeholders.
8. Continue to focus on a programme to reduce overall use of urinary catheters and ensure best practice for management of catheters *in situ*.
9. Further investigation is required to examine the PPS findings related to increasing oral cavity infections, and infections in paediatrics and mixed specialty hospital wards.

8.5. Device use

Six in ten of all patients surveyed (60.3%, 95%CI 57.2-60.3) had an invasive device in situ at the time of survey which was an increase compared to 2012 when half of patients had a device in situ (50.1%, 95%CI 49.4-52.5).

The prevalence of central vascular catheter CVC use was 5.4%, which was similar to that recorded in 2012. However, use of CVC in the adult ICU setting increased from 42.4% in 2012 to 74.3% in 2017. The second largest proportion of patients with a CVC was in Paediatrics (10.3%), followed by mixed ward specialities (9.8%). The overall rate of CVC use recorded in other UK administrations was similar to that reported in Northern Ireland, although the overall proportion of patients with a CVC in ICU tended to be lower than that observed locally.

The prevalence of urinary catheters was 17.8% (95%CI, 16.6-19.1) which was similar to that observed in 2012 (17.1%). The proportion of patients with a urinary catheter in place was lower than in Scotland (20.8%) and slightly lower than that observed for acute patients in Wales (19.2%) (3) (5).

The prevalence of patients intubated (either with a tracheostomy or endotracheal tube) on the day of survey was 2.0%, similar to the prevalence in 2012 (2.4%). Similar rates of intubation were recorded in other UK countries.

Use of peripheral vascular catheters (PVCs), increased from 43.4% in 2012 to 52.8% in 2017. This represents a challenge given the correlation between higher prevalence of line use and increasing risk of HAI. Given that Northern Ireland had the highest prevalence in 2012, an increase in this proportion in 2017, when other parts of the UK continue to report lower rates, requires further examination and action.

8.5.1 Summary of Device use priorities

1. Continue to promote awareness of the presence of invasive devices as a significant risk factor for development of HAI in the hospital setting by strengthening the implementation of high impact interventions such as care bundles. Countinued emphasis on education and training of clinical staff responsible for insertion and maintenance of invasive devices, including the regular assessment of competency of clinical staff and the use of hand hygiene/care bundles.
2. Emphasis should be on maintaining the current ICU incidence surveillance programme, validating data reported on, Ventilator Associated Pneumonia (VAP), Central Line Associated Blood Stream Infection (CLABSI) and Catheter Associated Urinary Tract Infection (CAUTI), and continue to ensure that units are recording data accurately and using it for quality improvement and benchmarking against other regions.
3. In wards where the prevalence of patients with a peripheral vascular catheter was high, a review should be considered with a view to developing interventions that ensure appropriate use and maintenance of peripheral lines including line reviews.

8.6 Microbiology

The majority of infections reported in PPS can be identified using epidemiological case definitions of signs and symptoms, without microbiological confirmation. Overall one third of infections had positive microbiology (n=85), with approximately two thirds meeting the case definitions in terms of available clinical signs and symptoms. As microbiological findings were based on results which were available on the day the PPS was conducted, the distribution of microorganisms is unlikely to reflect the full breadth of pathogens involved in HAI and results should be treated with caution.

Gram-positive cocci accounted for the largest proportion of microorganism identified in PPS 2017 (37.3%) including *Staphylococcus aureus*, 18.6% and *Enterococcus* spp 9.8%. Gram-negative Enterobacteriaceae accounted for 35.2% of isolates, with the largest proportion being *Escherichia coli*, 20.6%.

There were similar proportions of Enterobacteriaceae reported in other parts of the UK. For example, in Scotland the proportion of *Escherichia coli* was 22.7%, and the proportion of *Staphylococcus aureus* was 20.2% (1) (3).

The emergence of Enterobacteriaceae as one of the most frequent microorganisms detected in relation to HAI requires action, especially as the proportion of *Escherichia coli*, microorganisms has more than doubled between 2012 and 2017. Further investigation of the circumstances and environments in which these infections have developed is required to inform appropriate prevention and control strategies.

In PPS 2017, less than 0.1% of the total survey population had an infection caused by MRSA, which is comparable to the 2012 survey. *Clostridium difficile* infection was detected in 0.3% of the hospital population in 2017 compared to 0.2% in 2012. These findings are in keeping with data reported through incidence surveillance of both MRSA and *Clostridium difficile* Infection in Northern Ireland over recent years (26).

8.6.1 Summary of microbiology priorities

1. Continued focus on the importance of developing appropriate regional and local capacity to monitor antimicrobial use and antimicrobial resistance across hospitals as well as the characteristics of patients affected and relevant risk factors. This should include capacity to monitor gram-negative infections.

8.7 Antimicrobial use

In total, 2073 antimicrobials were being given to 1,385 patients in this survey which equates to 1.5 antimicrobials per patient and is similar to that seen in PPS 2012. Of the 1,385 patients 39% received two or more antimicrobials (Table 23). This indicates that the overall prevalence of AMU in acute care hospitals in Northern Ireland was 36.3%, higher than that reported in 2012. The Northern Ireland antimicrobial prevalence is similar to the corresponding figure for acute care reported in Scotland (35.4%) and Wales (34.2%) for 2016/2017 (Table 22) (1) (2) (4). The highest prevalence of antimicrobial prescribing in Northern Ireland 2017 was reported by secondary acute hospitals (39%) followed by primary acute hospitals (38.5%). The prevalence of antimicrobial prescribing in tertiary and specialised acute hospitals was 34% and 25% respectively. These findings highlight that there is an increase in the prevalence of AMU in the secondary and primary hospitals whilst there is no change in the AMU in tertiary and specialised hospitals in 2017 compared to 2012 (Table 32a). The increased usage and higher prevalence reinforces the ongoing need for effective antimicrobial stewardship and monitoring of prescribing practices to drive quality improvement (33) (28) (34) (35).

Over six in ten (62.4%) of antimicrobials were administered parenterally and 37% were given orally (Table 25). Although there has been a decrease in the proportion of patients who were receiving antibiotics parenterally in Northern Ireland (62.4% in 2017 compared to 65.2% in 2012) this is still considerably higher when compared to Scotland and Wales where rates were ten percentage points lower (3) (5). This finding suggests there is a potential opportunity to further improve de-escalation in antimicrobial use by switching from parenteral to oral antimicrobials. Stewardship strategies should continue to ensure early switch from parenteral to oral agents where appropriate, conferring potential benefits of reducing the need for intravenous access and facilitating earlier hospital discharge.

The proportion of children aged between 2-15 years in receipt of antimicrobials has decreased from 36.6%, the highest group in 2012, to 27% the second lowest in 2017 whilst antimicrobial use in patients over 65 years has increased from the previous PPS. In 2017 40% of older patients (aged 65 years and over) received antibiotics (Table 24), an increase since 2012 (31.8%), with 58.3% being administered parenterally. Effective improvement and antimicrobial stewardship strategies should particularly address AMU in older patients (e.g. Care of the Elderly and medical services).

In PPS 2017, AMU was greatest in adult ICU at 64.9%, followed by mixed specialty wards where 50.8% of patients were in receipt of antimicrobials (Table 33). Whilst the greatest use of antimicrobials in the ICU setting is likely to reflect the complex patient group managed in this specialty, investigation into why mixed specialty wards have such high antimicrobial use is required.

8.7.1 Indications for Antimicrobial use

The most frequent indication for antimicrobial use (60.6%) was for treatment of community acquired infections (Table 27). This finding highlights the importance of infection control in the community, and ensuring effective antimicrobial stewardship across Northern Ireland. Guidelines for antimicrobial use in primary care in Northern Ireland (35) (36) (37) must be robustly implemented in healthcare settings as well as the acute hospital environment and

those prescribing in primary and community care settings must be guided by best practice guidance.

The majority of antimicrobials used for treatment of infection were prescribed for respiratory tract infections (35%) (Table 28). Pneumonia was the most commonly identified infection accounting for 29% of all HAI reported (Figure 5a). Preventing pneumonia in hospitals as well as other care settings, including care at home and in the community would reduce the need for antimicrobials. Consideration should be given to developing local guidelines for Hospital acquired pneumonia (HAP) and Community-acquired pneumonia (CAP).

Approximately one in seven antimicrobials prescribed in PPS 2017 was administered for prophylaxis, 5.3% for surgical prophylaxis and 8.9% for medical prophylaxis. Compared to 2012 there has been a decrease in surgical and an increase in medical prophylaxis. The proportion of surgical prophylaxis given for longer than 24 hours was 25.3% in PPS 2017 compared to 11% in 2012 (Table 27). This proportion was lower than the corresponding proportion reported in Wales (32.7%) but higher than reported by Scotland (19.8%) (38). Further work is therefore required to validate these finding and to inform future strategies for improvement in AMU this area.

8.7.2 Prescribed antimicrobials

A total of 69 different antimicrobial agents were recorded in this survey. Six antimicrobials comprised almost half of all antimicrobial use and the top 20 most commonly prescribed antimicrobials accounted for 86% of all AMU (Table 29). This finding shows that clinicians use a relatively narrow range of antimicrobials, similar to other UK administrations. Meropenem, a very broad spectrum beta-lactam and often regarded as the last resort beta-lactam agent, was the tenth most frequently prescribed antimicrobial overall (3.6% of all AMU) (Table 29).

8.7.3 Compliance with local guidelines and documentation

Rationale for treatment was recorded for 93.9% antimicrobials prescribed in this survey. Documentation of rationale for treatment varied from 87% to 100% across acute hospitals. This is in keeping with that reported by other UK administrations.

PPS 2017 also included an assessment of compliance with local prescribing guidelines that exists in in each Trust. The majority of prescriptions (72.7%) were reported as compliant with local guideline and over one in ten antimicrobials prescribed (11.7%) were not compliant with local guidelines (Figure 15).

Currently there are no regionally agreed performance targets associated with antimicrobial prescribing in the hospital setting in Northern Ireland.

8.7.4 Antimicrobial use – Broad Spectrum

In acute hospitals in Northern Ireland, 7.6% of patients were receiving broad spectrum antimicrobials cephalosporins, co-amoxiclav, quinolones, clindamycin) that are associated with a higher risk of CDI. Co-amoxiclav was the third most prescribed antimicrobial and, where reported, the proportion that was not compliant with local guideline was one third. Although the current finding is a snapshot of AMU, it does indicate that there is a substantial burden of

prescribing broad spectrum antimicrobials and there are opportunities for further improvement particularly in adherence to local prescribing guidelines.

8.7.5 Antimicrobial use – Very Broad Spectrum

This PPS identified that the most common causative organisms were Gram-negative organisms. These organisms are prone to drug resistance and when these organisms develop multi-drug resistance there are very limited treatment options. The carbapenems (meropenem, imipenem and enzyme inhibitor, ertapenem) and piperacillin/tazobactam (a penicillin/enzyme inhibitor combination) are considered 'critically important' and their effectiveness preserved to ensure that patients can be successfully treated in the future.

On the day of the survey, 8.4% of patients were receiving piperacillin/tazobactam, and 2.1% were receiving a carbapenem. This is over twice the rates reported by Scotland (3). While the use of antimicrobial agents associated with *Clostridium difficile* infection was relatively low in this survey, 4.1% of all antimicrobial were cephalosporins and 4.8% fluoroquinolones; the prevalence of meropenem use is of concern at 3.6% of all antimicrobials.

Overall, 9.9% of carbapenem prescriptions and 15.5% of piperacillin/tazobactam were recorded as not compliant with local guideline, compared to 20% and 25% reported by Scotland.

Meropenem was the most prescribed carbapenem (92.6%) with 10.7% of prescriptions recorded as not compliant with local guideline.

Inappropriate use of antimicrobials is regarded as a major driver for the development of resistance in micro-organisms (33) . Regional and local Trust guidelines on the use of meropenem should be agreed and robustly implemented with a view to reserving meropenem use for clinically appropriate cases and to prevent carbapenem resistant enterobacteriaceae (CRE). Continued improvement in prescribing of these broad and very broad spectrum antimicrobials is essential to ensure they are preserved and that inappropriate use does not drive antimicrobial resistance.

8.7.6 Summary of antimicrobial priorities

1. Continued focus on the development and importance of effective antimicrobial stewardship in the hospital, primary, and community care settings.
2. Further developments are required for accurate assessment and monitoring of antimicrobial use, and implementation of regional guidelines across all Trusts, addressing the appropriate use of broad spectrum antimicrobials e.g. meropenem and piperacillin-tazobactam.
3. A set of quality indicators relating to antimicrobial prescribing needs to be considered at a Trust and Northern Ireland level. These should include compliance with local policy, review of antimicrobial use within 72 hours, recording of indication for treatment and the reason for any departure. Monitoring of these quality indicators should be facilitated through ongoing surveillance and feedback by regular reporting.
4. Regular reporting and assessment of antimicrobial consumption data for each hospital, with case-mix stratification should be implemented.

5. Sustained emphasis on ensuring appropriate antimicrobial use and on promoting early switch from parenteral to oral agents as clinically appropriate.
6. Consideration of a targeted programme aimed at reducing antimicrobial requirements and ensuring appropriate antimicrobial use for infections of the respiratory system, particularly including the diagnosis and treatment of pneumonia across the region.
7. Ongoing monitoring in relation to antimicrobials used for prophylaxis, and in particular surgical prophylaxis lasting longer than 24 hours / or more than one dose administered.
8. Sustained emphasis on antimicrobial stewardship and prescribing competencies, with particular emphasis on leadership provided through multi-disciplinary team working

9 Conclusions

The data from this survey should be used to support HAI improvement across hospitals in Northern Ireland. It should facilitate benchmarking locally and nationally, with a view to supporting and continuing HAI improvements achieved to date. The experience from delivering this PPS should be used to inform future options for PPS in Northern Ireland.

Northern Ireland has benefited from the full participation of all hospitals providing acute care, which has given representative data across the entire acute care setting. The evidence from this survey points to a number of key priorities for infection prevention and control as well as for antimicrobial stewardship that need careful consideration by individual Trusts, PHA and Department of Health (see pages 11-13). Further prevalence surveys of both HAI and AMU will be important to measure the overall impact of new policies, guidance and interventions in future years.

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Appendices

Appendix A – PPS delivery group and fieldwork documents

A.1 Regional PPS Delivery Group members

A.2 Patient Information leaflet

A.3 Hospital staff information leaflet

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Appendix B – ECDC tables

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Appendix C – Additional tables with comparison data between 2012 and 2017 PPS

C.I Device usage across ward specialities 2012 vs. 2017

C.II Distribution of HAI by Gender and Age Group 2012 vs. 2017

C.III Distribution of HAI by Hospital Type 2012 vs. 2017

C.IV Distribution of HAI by Risk Factors (Invasive device, Surgery, Underlying disease prognosis) 2012 vs. 2017

C.V Distribution of HAI by Ward Speciality 2012 vs. 2017

Appendix A.1 Regional PPS Delivery Group members

Name	Organisation
Dr. Muhammad Sartaj (Chair)	Consultant in Health Protection Public Health Agency
Mark McConaghy	Regional Surveillance Coordinator Public Health Agency
Gerard McIlvenny (until April 2017) Dr. Tony Crockford (from August 2017)	Surveillance Manager Public Health Agency
Caroline McGeary	Senior Infection Control Nurse Public Health Agency
Dr. Bronagh Clarke	Public Health Trainee Public Health Agency
Colin Clarke	Lead Nurse Infection Prevention & Control Southern Health and Social Care Trust
Dr. Naomi Baldwin	Lead Nurse Infection Prevention and Control Northern Health and Social Care Trust
Isobel King	Infection Prevention Lead South Eastern Health and Social Care Trust
Roisin Gillan	Senior Nurse, Infection Prevention and Control Belfast Health and Social Care Trust
Colin Lavelle	Senior Data Analyst Belfast Health and Social Care Trust
Cairine Gormley	Lead Antimicrobial Pharmacist Western Health and Social Care Trust
Clare Robertson	Infection Prevention & Control Nurse Western Health and Social Care Trust

Will patients benefit from the survey?

This hospital is taking part in the survey to learn more about hospital-acquired infections and antibiotic use in this hospital, in Northern Ireland and in Europe.

The results of the survey for this hospital will be used by nurses, doctors and managers to improve antibiotic use, reduce hospital-acquired infections and improve patient care.

Will I need to have extra tests?

No. The information for the survey will be taken from the results of previous tests. No extra tests will be needed.

Will my care be affected in any way?

No. Your normal care will not be affected in any way. All the information needed to complete the survey is already available in your notes or from the nurse or doctor who is looking after you.

Can I be identified by the data collected?

No. **There will be no personally-identifying information collected.** All data collected is anonymous. The information collected is: age, gender, the type of ward a patient is admitted to (i.e. medical ward, surgical ward or intensive care unit), whether or not a patient has a drip or urinary catheter, had recent surgery, receives antibiotics and if a hospital-acquired infection is present.

POINT PREVALENCE SURVEY (PPS) OF HOSPITAL-ACQUIRED INFECTIONS AND ANTIMICROBIAL USE IN NORTHERN IRELAND

Patient information

What is this survey about?

The European Centre for Disease Prevention and Control is overseeing a large survey across Europe, designed to answer two questions:

1. What percentage of patients develop an infection as a result of being admitted to hospital?
2. What percentage of patients in hospital receive antibiotics?

This is the second survey to be carried out across all European countries. The survey will take place in hospitals in Northern Ireland in May 2017.

Hospital-acquired infection

- Why does infection happen in a hospital environment?

Infection can happen anywhere, but patients in hospital are more prone to infection than people elsewhere. This is because they have either just had medical treatments or operations that make them more vulnerable, or because they are more elderly. Their natural defences are lowered and so they are more likely to be affected by bacteria that enter their system.

- What causes infection?

Infection can happen when bacteria enter part of the body at a place where they are not meant to be. For instance, they can enter:

- through a wound or cut (including a cut made during an operation)
- through a medical device that is inserted into the body – such as a drip into a vein or a catheter into the bladder
- when we breathe (in the same way as when you catch a cold)
- when we swallow them, if the bacteria are on our fingers or in food.

- How can I prevent it happening to me or others?

You can reduce the likelihood of getting a hospital-acquired infection by always checking that staff have washed their hands or used an antibacterial hand rub before they touch you. You can wash your own hands regularly (after contact with other patients or staff, after going to the toilet and before and after eating).

Why is information being collected on the use of antibiotics?

The survey will check the number of patients receiving antibiotics.

The information collected will help to identify areas where antibiotic use may be improved.

- Antibiotics are very important to treat infections
- Bacteria are always finding new ways to become resistant to antibiotics
- Infections that are caused by antibiotic-resistant bacteria, such as MRSA, are more difficult to treat
- Sometimes antibiotics are used unnecessarily, for example, on infections caused by viruses
- Unnecessary antibiotic use contributes to an increased risk of hospital-acquired infections

What happens during the survey?

- The hospital has a team of nurses and doctors who will go to every ward and check which patients have a hospital-acquired infection and which patients are receiving antibiotics.
- The survey team will also check notes, charts and laboratory results to decide if a patient has a hospital-acquired infection or is receiving antibiotics.

What will happen to the data collected during the PPS?

Your PPS team will send your hospital data to the Public Health Agency for analysis.

When all participating hospitals have submitted data, a hospital PPS report will be produced by the PHA. The PPS team leader should forward details of the report to healthcare workers and managers in your hospital. Your hospital's results can be compared with the overall Northern Ireland results.

All data collected from participating hospitals will be submitted by the PHA to European Centre for Disease Prevention and Control (ECDC) for inclusion in a European report. Results from Northern Ireland can be compared with those of other countries.

What will happen after the PPS?

Taking part in the PPS will provide information about hospital-acquired infections and antibiotic use in your hospital in Northern Ireland and in Europe.

The PPS results for your hospital should be used to inform interventions to reduce unnecessary antimicrobial use, reduce hospital-acquired infections and improve patient care.

The PPS results will be used to direct national and regional strategies for prudent antimicrobial use and work towards reduction of hospital-acquired infections.

THANK YOU FOR SUPPORTING THE PPS IN YOUR HOSPITAL

Further information and patient information leaflet are available from your local team.

ecdc
EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

POINT PREVALENCE SURVEY (PPS) OF HOSPITAL-ACQUIRED INFECTIONS AND ANTIMICROBIAL USE IN NORTHERN IRELAND

Healthcare staff information leaflet

HSC Public Health Agency

What is the point prevalence survey (PPS) about?

The European Centre for Disease Prevention and Control is overseeing a Europe-wide hospital point prevalence survey (PPS). A PPS provides a 'snapshot' of a particular issue at a fixed point in time. This PPS is designed to answer two questions:

1. What percentage of patients admitted to European hospitals develop a hospital-acquired infection (HAI)?
2. What percentage of patients admitted to European hospitals receive antimicrobials?

This is the second European PPS conducted using the same protocol. Up to 100,000 European patients will be surveyed. Our hospitals have been invited to participate in the PPS, which takes place in May 2017. The PPS in NI is coordinated by the Public Health Agency (PHA), the Agency is responsible for the monitoring of infectious diseases and antimicrobial use.

What data will be collected?

- Anonymous demographic data (age, gender, ward specialty) and risk factor data (recent surgery, presence of vascular catheters, urethral catheters, intubation and severity of underlying illness) will be collected on all eligible patients admitted to the hospital.
- Antimicrobial use data (systemic antibacterials and/or antifungals) for treatment of infection or prophylaxis will be collected on patients who receive antimicrobials (estimated at about one third).
- Hospital-acquired infection data will be collected on eligible patients meeting case definitions of a hospital-acquired infection (estimated at about one in twenty).

When and how will the PPS data be collected?

- This hospital will participate in the 2017 PPS and some of your colleagues have volunteered to act as the local data collection team. Members of the team will attend a one-day training course to learn about the protocol and the HAI definitions.
- The PPS team leader will plan the schedule for the hospital. All data for the hospital must be collected on weekdays during May 2017.
- The PPS team will visit every ward in the hospital, collecting data on all eligible patients in each ward within the same day. Performing the PPS for an entire hospital is a big undertaking for your local PPS team. Your support and cooperation is very important to ensure the survey is a success and provides accurate information on hospital-acquired infection and antimicrobial use in your hospital.
- Night-shift nursing or midwifery staff will be asked to help the PPS team by collecting demographic and risk factor data on each patient on the ward.
- Nursing/midwifery staff and medical staff who know the patients will be asked to help the PPS team by discussing clinical information, helping to decide the patient's underlying severity of illness and whether a patient meets case definitions for a HAI.
- **NO personally-identifying information will be collected.** Data collected is anonymous and will include: general demographic information, risk factors, antimicrobial use and HAI data.

Appendix A.4 Ward Census

Public Health Agency

Ward List A2

Ward details should be completed by Ward contact/manager and PPS team lead in advance of survey

Ward name ______________________

Hospital Code [| |] Ward code [|] Ward specialty [ ]

COMPLETED BY WARD STAFF FOR ALL PATIENTS ON THE WARD													COMPLETED BY PPS DATA TEAM	
		M/F	Years or Months	Neonate <4 weeks	DD/MM/YY	+	+	+	+	+	+	+	+	
Bed number	Patient name	Gender	Age Or month if <2 years old	Birth weight	Admission date	Surgery since admission	Surgery in last 24 hrs	Central vascular catheter	Peripheral vascular catheter	Urethral Catheter	Intubation	Patient on antimicrobial	Eligible patient	Patient Study Number
												Total		

Note: If there are more than 20 beds on ward please continue on another Ward List – Completed Ward Lists to be retained by the PPS team leader

Appendix A.5 Patient Form (page 1)

SURVEY OF HOSPITAL-ACQUIRED INFECTIONS & ANTIMICROBIAL USE

2017 PPS - PATIENT FORM C v2.1

1. Patient details *Hospital code* *Ward code* *Patient ID*

Unique identifier ☐☐ - ☐☐ - ☐☐

Consultant specialty [MIA PickList]

Age in years... If <2 enter '00' ☐☐☐ Age in months under 2-year old (neonates <4-weeks enter '00') ☐☐

Birth weight in grams if neonate <4-weeks old ☐☐☐☐ grams

Gender ☐ Male ☐ Female

Admission date to this hospital D D / M M / Y Y

2. Risk factors

Surgery since admission ☐ No ☐ Yes → [MIA PickList] *Surgical procedure*

Central vascular catheter ☐ No ☐ Yes

Peripheral vascular catheter ☐ No ☐ Yes

Uretheral catheter ☐ No ☐ Yes

Intubation ☐ No ☐ Yes

Underlying disease prognosis ☐ None/non-fatal diseas ☐ End of life prognosi ☐ Life limiting prognosi ☐ Not knowr

3. Condition of interest

Patient has active HAI ☐ No ☐ Yes Patient on antimicrobials ☐ No ☐ Yes

4. Hospital-acquired infection data (HAI) ...if more than 1 HAI use extension sheet Page 4

HAI 1

Infection [MIA PickList]

If SSI, record procedure [MIA PickList]

If BSI record source [MIA PickList]

Date admitted to current ward D D / M M / Y Y

Relevant device in situ before onset ☐ Yes ☐ No

HAI Present at admission ☐ Yes ☐ No

Origin of infection ☐ Current hospita ☐ Other acute hospita ☐ Other origin

Date of onset D D / M M / Y Y

Microorganism 1 [MIA PickList] Resistance 1 [MIA PickList]

Microorganism 2 [MIA PickList] Resistance 2 [MIA PickList]

Microorganism 3 [MIA PickList] Resistance 3 [MIA PickList]

Appendix A.5 Patient Form (page 2)

Hospital code Ward code Patient ID
☐☐ - ☐☐ - ☐☐

5. Antimicrobial use ... if more than 2 antimicrobials use extension sheet Page 3

First Antimicrobial MIA PickList

Route ☐ Parenteral ☐ Oral ☐ Rectal ☐ Inhalation

Doses per day ☐.☐☐ Note: alternate day dosing = 0.5; 2 doses per week = 0.29; 3 doses per week = 0.43

Strength of 1 dose ☐☐☐.☐ Unit of measurement ☐ grams ☐ mg ☐ Other

Indication for antimicrobial use MIA PickList

Diagnosis site code MIA PickList

Reason recorded in notes ☐ No ☐ Yes ☐ Notes not available

Meets local policy ☐ No ☐ Yes ☐ Not assessable ☐ Not known

Date started on current antimicrobial D D / M M / Y Y

Does current antimicrobial (choice or route) for this infection episode represent a change from what was originally prescribed? ☐ No ☐ Yes

Reason for change MIA PickList

If change, date antimicrobial started for infection/indication D D / M M / Y Y

Second Antimicrobial MIA PickList

Route ☐ Parenteral ☐ Oral ☐ Rectal ☐ Inhalation

Doses per day ☐.☐☐ Note: alternate day dosing = 0.5; 2 doses per week = 0.29; 3 doses per week = 0.43

Strength of 1 dose ☐☐☐.☐ Unit of measurement ☐ grams ☐ mg ☐ Other

Indication for antimicrobial use MIA PickList

Diagnosis site code MIA PickList

Reason recorded in notes ☐ No ☐ Yes ☐ Notes not available

Meets local policy ☐ No ☐ Yes ☐ Not assessable ☐ Not known

Date started on current antimicrobial D D / M M / Y Y

Does current antimicrobial (choice or route) for this infection episode represent a change from what was originally prescribed? ☐ No ☐ Yes

Reason for change MIA PickList

If change, date antimicrobial started for infection/indication D D / M M / Y Y

Appendix A.6 Hospital Form

HSC Public Health Agency | hpsc | HSE | Office of the Nursing & Midwifery Services Director

2017 SURVEY OF HOSPITAL-ACQUIRED INFECTIONS AND ANTIMICROBIAL USE

Hospital Form B

Page 1

Hospital

Survey dates *from* D D / M M / Y Y *to* D D / M M / Y Y

Hospital size (total number of beds)

Number of acute care beds

Number of ICU beds

Any exclusion of wards for PPS? Yes ☐ No ☐

If Yes, specify ward specialty of excluded wards

Year figures compiled Record calender year e.g. for 2016/17 enter 16

Number of admissions in year

Number of patient days in year

Number of WTE infection control nurses, e.g. 05.25

Number of WTE infection control doctors, e.g. 01.50

Number of WTE antimicrobial pharmacists, e.g. 01.50

Number of WTE registered nurses

Number of WTE nursing assistants

Number of WTE registered nurses in ICU

Number of WTE nursing assistants in ICU

Number of designated airborne isolation rooms

Alcohol hand rub consumption (litres)

Number of observed hand hygiene opportunities

Number of blood culture sets processed from inpatients

Number faeces specimens from inpatients tested for *C. difficile*

2017 SURVEY OF HOSPITAL-ACQUIRED INFECTIONS AND ANTIMICROBIAL USE

Hospital Form B

Page 2

Infection prevention and control (IPC) programme:

Is there an **annual IPC plan**, approved by the hospital CEO or a senior executive officer? Yes ☐ No ☐

Is there an **annual IPC report**, approved by the hospital CEO or a senior executive officer? Yes ☐ No ☐

Microbiology/diagnostic performance:

At weekends, can clinicians request routine microbiological tests and receive back results?

	Saturday	Sunday
Clinical tests	☐	☐
Screening tests	☐	☐

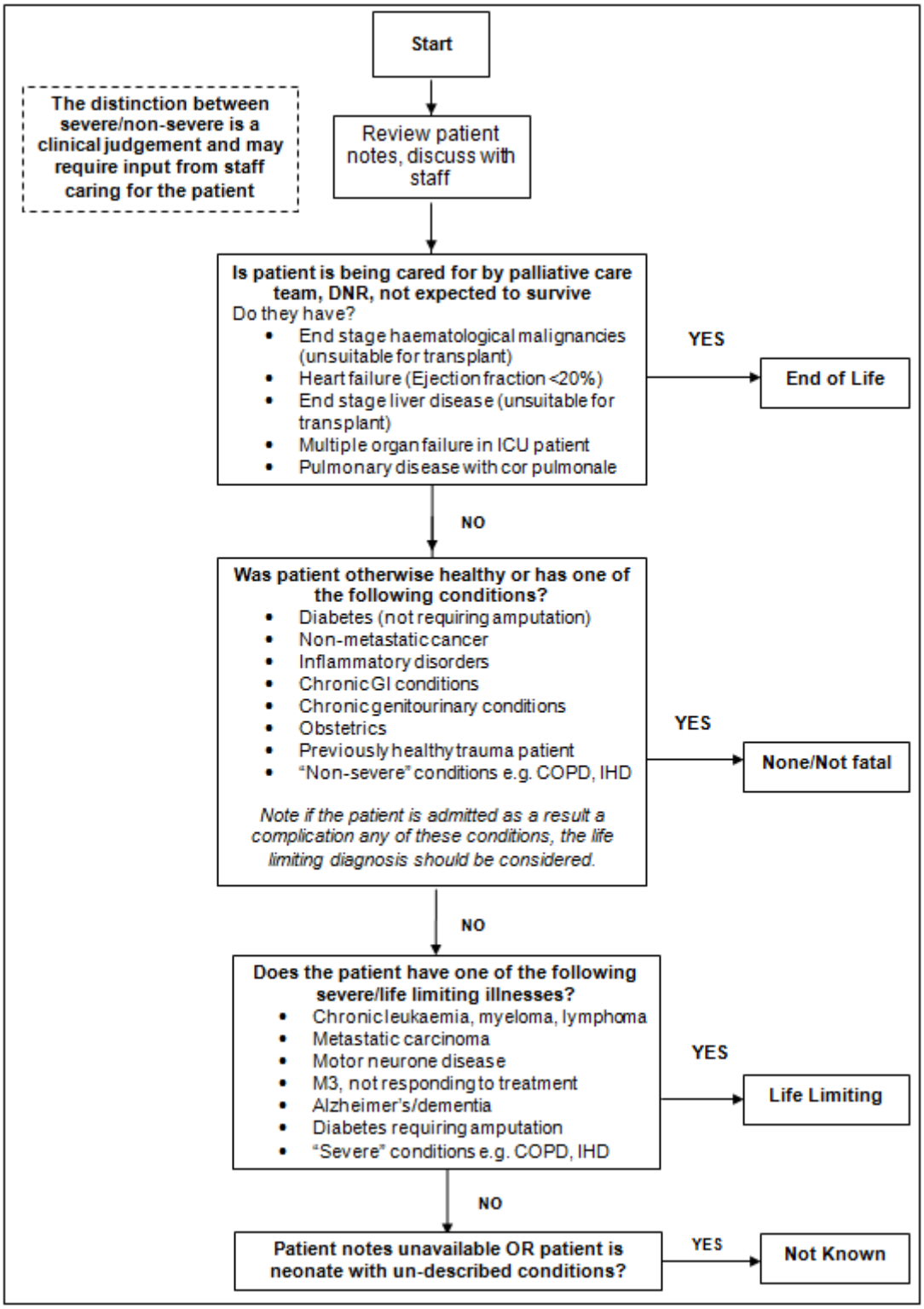
Does your ICU have the following in place for HAI prevention or antimicrobial stewardship?

	Guideline	Care bundle	Training	Checklist	Audit	Surveillance	Feedback
Pneumonia	☐	☐	☐	☐	☐	☐	☐
Blood stream infections	☐	☐	☐	☐	☐	☐	☐
Urinary tract infections	☐	☐	☐	☐	☐	☐	☐
Antimicrobial use	☐	☐	☐	☐	☐	☐	☐

Does your hospital (outside of ICU) have the following for HAI prevention or antimicrobial stewardship?

	Guideline	Care bundle	Training	Checklist	Audit	Surveillance	Feedback
Pneumonia	☐	☐	☐	☐	☐	☐	☐
Blood stream infections	☐	☐	☐	☐	☐	☐	☐
Surgical site infections	☐	☐	☐	☐	☐	☐	☐
Urinary tract infections	☐	☐	☐	☐	☐	☐	☐
Antimicrobial use	☐	☐	☐	☐	☐	☐	☐

Appendix A.7 Underlying disease prognosis



Appendix A.8 Algorithm for the definition of Hospital associated Infection

Onset of HAI		Case Definition
All HAI types *Day 3 onwards*	***AND***	Meets the case definition on the day of survey
OR		
All HAI types *Admission, day 1 or day 2 AND patient discharged from hospital, acute or non-acute, in preceding 48 hours*		
OR		OR
Surgical Site Infection *Admission, day 1 or day 2* *An SSI is defined as any SSI type which occurs within 30 days of infection of the operation date. In the case of surgery involving an implant, deep or organ space SSI arising up to 90 days after surgery is also considered and the patient either has symptoms that meet the case definition and/or is on antimicrobial treatment for infection.*		Patient is receiving antimicrobials **AND** HAI has previously met the case definition between day 1 of antimicrobial treatment and survey day
OR		
***Clostridium difficile* infection** *Admission, day 1 or day 2 AND patient discharged from hospital, acute or non-acute, in preceding 28 days*		
OR		
Device associated infection *Relevant device in situ prior to onset*		
OR		
Neonatal infection *Count any active infection arising after birth while infant remains in hospital*		

Appendix A.9 Key Protocol Changes 2017 versus 2012

- Inclusion criteria now *include* chronic care wards in acute care hospitals.
- Inclusion of new structure and process indicators for HAI and AMR prevention at hospital and ward level. Requirement for the local PPS team to gather ward level process indicators for inclusion on each ward list
- Hospital level:
    - Hospital ownership, more details on administrative hospital groups
    - Hospital size = total beds minus exclusive day beds. Day beds were not excluded from hospital size in 2012 PPS
    - Hospital level data on blood culture sets and faeces specimens tested for *C. difficile* processed on inpatients in previous year
    - IPC plan and report, participation in surveillance programmes, weekend access to microbiology tests and results, availability of multi-modal strategies in hospital and ICU(s) for prevention of certain HAI types and for antimicrobial stewardship
- Ward data: Simplified ward specialty variable
- Patient data:
    - Birth weight for neonates <4-weeks old by PPS date
- Antimicrobial use data:
    - Date of start of the antimicrobial; was the antimicrobial changed and if so, what was the reason for change of the antimicrobial and what was the date of start of the first antimicrobial given for this indication. Information on changing antimicrobials (+reason) will allow evaluating actual efforts to improve antimicrobial prescribing and adds local value to the PPS for the hospitals. The start dates serve as proxy indicator of the validity (sensitivity and specificity) of the prevalence of HAIs and will be used to estimate the burden antimicrobial use (prevalence to incidence conversion); as indicator of data validity, this variable needs to be interpreted together with the validation studies performed during the national PPS.
    - Dosage per day (number, strength and unit if doses per day): for EU/US comparisons and to enable DDD updates.

- HAI and AMR data:
    - HAI associated to current ward, or another ward since admission.
    - AMR marker data collected as S/I/R/UNK rather than as susceptible/non-susceptible.
- Codebook:
    - Specialty list: new ward specialty code list (with only main specialties), added consultant/patient specialty codes for healthy neonates
    - Diagnosis (site) code list for antimicrobial use: surgical site infection (SSI) was added as a subcategory of both SST and BJ; addition of cystic fibrosis (CF) as a separate entry
    - Antimicrobial ATC codes: updated with new codes added since 2011
    - HAI case definitions:
        - Surgical site infection (SSI): follow-up period of deep and organ/space SSIs after implant surgery changed from one year to 90 days.
        - Pneumonia (PN): note added indicating that one definitive chest X-ray or CT-scan for the current pneumonia episode may be sufficient in patients with underlying cardiac or pulmonary disease if comparison with previous X-rays is possible.
        - *Clostridium difficile* infection (GI-CDI): definition aligned to the case definition in the CDI surveillance protocol, to account for other methods to detect toxin-producing C. difficile organism in stool.
        - SYS-CSEP: no change in the definition, but change of the name from ‘clinical sepsis’ to ‘treated unidentified severe infection’ in adults and children, to differentiate this ‘last resort’ HAI case definition from the modern concept of sepsis based on organ dysfunction.

Appendix B Table I (2017)

Table I. Distribution of healthcare-associated infection sites	Total UK-NI (n=16)			
	N pts (1)	Pr% (95%CI) (2)	N HAI (3)	Rel% (4)
Total	**234**	**6.1% (5.4-6.9)**	**241**	**100%**
Pneumonia	71	1.9% (1.5-2.3)	71	29.5%
PN1 (Pneumonia, clinical + positive quantitative culture from minimally contaminated lower respiratory tract specimen)	1	0.0% (0.0-0.1)	1	0.4%
PN4 (Pneumonia, clinical + positive sputum culture or non-quantitative culture from lower respiratory tract specimen)	6	0.2% (0.1-0.3)	6	2.5%
PN5 (Pneumonia - Clinical signs of pneumonia without positive microbiology)	63	1.7% (1.3-2.1)	63	26.1%
NEO-PNEU (Pneumonia in neonates)	1	0.0% (0.0-0.1)	1	0.4%
Other lower respiratory tract inf.	6	0.2% (0.1-0.3)	6	2.5%
LRI-BRON (Bronchitis, tracheobronchitis, bronchiolitis, tracheitis, without evidence of pneumonia)	6	0.2% (0.1-0.3)	6	2.5%
Surgical site infections	41	1.1% (0.8-1.5)	41	17.0%
SSI-S (Surgical site infection, Superficial incisional)	11	0.3% (0.1-0.5)	11	4.6%
SSI-D (Surgical site infection, Deep incisional)	10	0.3% (0.1-0.5)	10	4.1%
SSI-O (Surgical site infection, Organ/Space)	20	0.5% (0.3-0.8)	20	8.3%
Urinary tract infections	15	0.4% (0.2-0.6)	15	6.2%
UTI-A (symptomatic urinary tract infection, microbiologically confirmed)	9	0.2% (0.1-0.4)	9	3.7%
UTI-B (symptomatic urinary tract infection, not microbiologically confirmed)	6	0.2% (0.1-0.3)	6	2.5%
Bloodstream infections	24	0.6% (0.4-0.9)	24	10.0%
BSI (Bloodstream infection (laboratory-confirmed) , other than CRI3)	20	0.5% (0.3-0.8)	20	8.3%
CRI3-CVC (Microbiologically confirmed CVC-related bloodstream infection)	1	0.0% (0.0-0.1)	1	0.4%
NEO-LCBI (Laboratory-confirmed bloodstream infection in neonates, non-CNS)	2	0.1% (0.0-0.2)	2	0.8%
NEO-CNSB (Laboratory-confirmed bloodstream infection with coagulase-negative staphylococci in neonates)	1	0.0% (0.0-0.1)	1	0.4%
Cardiovascular system infections	1	0.0% (0.0-0.1)	1	0.4%
CVS-ENDO (Endocarditis)	1	0.0% (0.0-0.1)	1	0.4%
Gastro-intestinal system infections	26	0.7% (0.4-1.0)	26	10.8%
GI-CDI (Clostridium difficile infection)	14	0.4% (0.2-0.6)	14	5.8%
GI-GIT (Gastrointestinal tract (esophagus, stomach, small and large bowel, and rectum), excl. GE, CDI)	5	0.1% (0.0-0.3)	5	2.1%
GI-IAB (Intraabdominal infection, not specified elsewhere)	6	0.2% (0.1-0.3)	6	2.5%
NEO-NEC (Necrotising enterocolitis)	1	0.0% (0.0-0.1)	1	0.4%
Skin and soft tissue infections	11	0.3% (0.1-0.5)	11	4.6%
SST-SKIN (Skin infection)	10	0.3% (0.1-0.5)	10	4.1%
SST-ST (Soft tissue (necrotizing fascitis, infectious gangrene, necrotizing cellulitis, infectious myositis, lymphadenitis, or lymphangitis))	1	0.0% (0.0-0.1)	1	0.4%
Bone and joint infections	3	0.1% (0.0-0.2)	3	1.2%
BJ-BONE (Osteomyelitis)	2	0.1% (0.0-0.2)	2	0.8%
BJ-DISC (Disc space infection)	1	0.0% (0.0-0.1)	1	0.4%
Central nervous system infections	2	0.1% (0.0-0.2)	2	0.8%
CNS-IC (Intracranial infection)	1	0.0% (0.0-0.1)	1	0.4%
CNS-MEN (Meningitis or ventriculitis)	1	0.0% (0.0-0.1)	1	0.4%
Eye, Ear, Nose or Mouth infection	16	0.4% (0.2-0.7)	16	6.6%
EENT-ORAL (Oral cavity (mouth, tongue, or gums))	16	0.4% (0.2-0.7)	16	6.6%
Systemic infections	25	0.7% (0.4-1.0)	25	10.4%
SYS-DI (Disseminated infection)	2	0.1% (0.0-0.2)	2	0.8%
SYS-CSEP (Treated unidentified severe infection in adults and children)	13	0.3% (0.2-0.6)	13	5.4%
NEO-CSEP (Clinical sepsis in neonates)	10	0.3% (0.1-0.5)	10	4.1%
LEGEND:				
(1,2) number and % of infected patients (site-specific prevalence)				
(3,4) number of HAI and percentage of total HAI (relative frequency)				

Appendix B Table II (2017)

Table II. List of surgical procedures with associated HAI and AM use

	Total UK-NI (n=16)					
	N (1)	% tot (2)	n HAI	% HAI (3)	n AM	% AM (3)
AAA-Abdominal aortic aneurysm repair	7	0.2%	0	0.0%	3	42.9%
AMP-Limb amputation	7	0.2%	0	0.0%	0	0.0%
APPY-Appendix surgery	6	0.2%	0	0.0%	4	66.7%
AVSD-Shunt for dialysis	0	0.0%	0	.%	0	.%
BILI-Bile duct, liver or pancreatic surgery	5	0.1%	0	0.0%	1	20.0%
BRST-Breast surgery	10	0.3%	1	10.0%	5	50.0%
CARD-Cardiac surgery	18	0.5%	3	16.7%	9	50.0%
CBGB-Coronary artery bypass graft with both chest and donor site incisions	2	0.1%	2	100.0%	2	100.0%
CBGC-Coronary artery bypass graft with chest incision only	7	0.2%	1	14.3%	6	85.7%
CEA-Carotid endarterectomy	0	0.0%	0	.%	0	.%
CHOL-Gallbladder surgery	11	0.3%	2	18.2%	4	36.4%
COLO-Colon surgery	48	1.3%	6	12.5%	18	37.5%
CRAN-Craniotomy	16	0.4%	0	0.0%	2	12.5%
CSEC-Cesarean section	31	0.8%	1	3.2%	14	45.2%
FUSN-Spinal fusion	3	0.1%	0	0.0%	0	0.0%
FX-Open reduction of fracture	44	1.2%	4	9.1%	8	18.2%
GAST-Gastric surgery	8	0.2%	1	12.5%	3	37.5%
HER-Herniorrhaphy	7	0.2%	1	14.3%	2	28.6%
HPRO-Hip prosthesis	54	1.4%	7	13.0%	18	33.3%
HTP-Heart transplant	0	0.0%	0	.%	0	.%
HYST-Abdominal hysterectomy	3	0.1%	1	33.3%	1	33.3%
KPRO-Knee prosthesis	30	0.8%	4	13.3%	10	33.3%
KTP-Kidney transplant	2	0.1%	0	0.0%	0	0.0%
LAM-Laminectomy	11	0.3%	1	9.1%	1	9.1%
LTP-Liver transplant	2	0.1%	1	50.0%	1	50.0%
NECK-Neck surgery	0	0.0%	0	.%	0	.%
NEPH-Kidney surgery	13	0.3%	2	15.4%	6	46.2%
OVRY-Ovarian surgery	16	0.4%	2	12.5%	4	25.0%
PACE-Pacemaker surgery	5	0.1%	0	0.0%	0	0.0%
PRST-Prostate surgery	0	0.0%	0	.%	0	.%
PVBY-Peripheral vascular bypass surgery	6	0.2%	2	33.3%	2	33.3%
REC-Rectal surgery	3	0.1%	0	0.0%	0	0.0%
RFUSN-Refusion of spine	1	0.0%	0	0.0%	0	0.0%
SB-Small bowel surgery	19	0.5%	4	21.1%	7	36.8%
SPLE-Spleen surgery	2	0.1%	1	50.0%	2	100.0%
THOR-Thoracic surgery	8	0.2%	0	0.0%	1	12.5%
THYR-Thyroid and/or parathyroid surgery	4	0.1%	1	25.0%	1	25.0%
VHYS-Vaginal hysterectomy	6	0.2%	0	0.0%	0	0.0%
VSHN-Ventricular shunt	5	0.1%	1	20.0%	2	40.0%
XLAP-Exploratory laparotomy	0	0.0%	0	.%	0	.%

LEGEND:

(1) total number of patients in category

(2) percentage of total (column percent), (3) percentage of category total (row percent)

HAI: patients with >=1 healthcare-associated infection, AM: patients receiving >=1 antimicobial agent

Appendix B Table III (2017)

Table III. HAI and antimicrobial use by patient risk factors (standard protocol only)

	Total UK-NI (n=16)					
	N (1)	% tot (2)	n HAI	% HAI (3)	n AM	% AM (3)
All patients	3813	100.0%	234	6.1%	1385	36.3%
Age						
<1y	153	4.0%	13	8.5%	30	19.6%
1-4y	93	2.4%	5	5.4%	30	32.3%
5-14y	68	1.8%	0	0.0%	17	25.0%
15-24y	123	3.2%	2	1.6%	43	35.0%
25-34y	258	6.8%	6	2.3%	72	27.9%
35-44y	208	5.5%	13	6.3%	74	35.6%
45-54y	315	8.3%	24	7.6%	110	34.9%
55-64y	477	12.5%	23	4.8%	171	35.8%
65-74y	654	17.2%	44	6.7%	270	41.3%
75-84y	912	23.9%	71	7.8%	344	37.7%
>=85y	552	14.5%	33	6.0%	224	40.6%
Gender						
F	2050	53.8%	99	4.8%	724	35.3%
M	1763	46.2%	135	7.7%	661	37.5%
Length of stay (7)						
1-3d	1301	34.1%	29	2.2%	409	31.4%
4-7d	971	25.5%	74	7.6%	454	46.8%
8-14d	739	19.4%	58	7.8%	287	38.8%
>2w	792	20.8%	73	9.2%	232	29.3%
Missing/Unk	10	0.3%	0	0.0%	3	30.0%
Surgery since admission						
No surgey	3181	83.4%	163	5.1%	1149	36.1%
NHSN surgery	482	12.6%	58	12.0%	164	34.0%
Non-NHSN/minimal surgery	123	3.2%	12	9.8%	61	49.6%
Missing/Unk	27	0.7%	1	3.7%	11	40.7%
McCabe score						
Non fatal disease	2477	65.0%	139	5.6%	836	33.8%
Ultimately fatal disease	735	19.3%	57	7.8%	359	48.8%
Rapidly fatal disease	182	4.8%	15	8.2%	78	42.9%
Missing/Unk	419	11.0%	23	5.5%	112	26.7%
Central vascular catheter						
No	3606	94.6%	203	5.6%	1251	34.7%
Yes	207	5.4%	31	15.0%	134	64.7%
Missing/Unk	0	0.0%	0	.%	0	.%
Peripheral vascular catheter						
No	1800	47.2%	60	3.3%	365	20.3%
Yes	2013	52.8%	174	8.6%	1020	50.7%
Missing/Unk	0	0.0%	0	.%	0	.%
Urinary catheter						
No	3134	82.2%	149	4.8%	1053	33.6%
Yes	679	17.8%	85	12.5%	332	48.9%
Missing/Unk	0	0.0%	0	.%	0	.%
Intubation						
No	3735	98.0%	225	6.0%	1349	36.1%
Yes	78	2.0%	9	11.5%	36	46.2%
Missing/Unk	0	0.0%	0	.%	0	.%
Birthweight						
>=2500g	103	2.7%	7	6.8%	18	17.5%
<2500g	42	1.1%	6	14.3%	10	23.8%
NA/Missing/Unk	3668	96.2%	221	6.0%	1357	37.0%

LEGEND:
(1)total number of patients in category
(2) percentage of total (column percent), (3)percentage of category total (row percent)
HAI: patients with >=1 healthcare-associated infection, AM: patients receiving >=1 antimicobial agent
(7) Length of stay until date of onset HAI if HAI during current hospital stay

Appendix B Table IV (part 1) 2017

Table IV. Antimicrobial agents (ATC4 and ATC5) by indication								
Page 1 of 2	Total UK-NI (n=16)							
	Total	%	Trt	%	SP	%	MP	%
Total N of antimicrobial agents	2072	100.0%	1742	100.0%	111	100.0%	184	100.0%
A07AA (Intestinal antiinfectives, antibiotics)	89	4.3%	47	2.7%	0	0.0%	37	20.1%
A07AA02 (Nystatin)	60	2.9%	33	1.9%	0	0.0%	24	13.0%
A07AA07 (Amphotericin B (oral))	1	0.0%	1	0.1%	0	0.0%	0	0.0%
A07AA09 (Vancomycin (oral))	8	0.4%	8	0.5%	0	0.0%	0	0.0%
A07AA10 (Colistin (oral))	1	0.0%	1	0.1%	0	0.0%	0	0.0%
A07AA11 (Rifaximin)	17	0.8%	2	0.1%	0	0.0%	13	7.1%
A07AA12 (Fidaxomicin)	2	0.1%	2	0.1%	0	0.0%	0	0.0%
D01BA (Antifungals for systemic use)	1	0.0%	0	0.0%	0	0.0%	0	0.0%
D01BA02 (Terbinafine)	1	0.0%	0	0.0%	0	0.0%	0	0.0%
J01AA (Tetracyclines)	98	4.7%	86	4.9%	1	0.9%	7	3.8%
J01AA01 (Demeclocycline)	6	0.3%	3	0.2%	0	0.0%	1	0.5%
J01AA02 (Doxycycline)	87	4.2%	79	4.5%	1	0.9%	6	3.3%
J01AA06 (Oxytetracycline)	1	0.0%	0	0.0%	0	0.0%	0	0.0%
J01AA12 (Tigecycline)	4	0.2%	4	0.2%	0	0.0%	0	0.0%
J01CA (Penicillins, extended spectrum without anti-pseudomonal activity)	181	8.7%	170	9.8%	1	0.9%	7	3.8%
J01CA04 (Amoxicillin)	177	8.5%	167	9.6%	1	0.9%	6	3.3%
J01CA08 (Pivmecillinam)	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J01CA12 (Piperacillin)	2	0.1%	1	0.1%	0	0.0%	1	0.5%
J01CA17 (Temocillin)	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J01CE (Beta-lactamase sensitive penicillins)	52	2.5%	45	2.6%	0	0.0%	7	3.8%
J01CE01 (Benzylpenicillin)	46	2.2%	43	2.5%	0	0.0%	3	1.6%
J01CE02 (Phenoxymethylpenicillin)	5	0.2%	1	0.1%	0	0.0%	4	2.2%
J01CE30 (Combinations of beta-lactamase sensitive penicillins)	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J01CF (Beta-lactamase resistant penicillins)	94	4.5%	80	4.6%	14	12.6%	0	0.0%
J01CF05 (Flucloxacillin)	94	4.5%	80	4.6%	14	12.6%	0	0.0%
J01CG (Beta-lactamase inhibitors)	10	0.5%	9	0.5%	1	0.9%	0	0.0%
J01CG02 (Tazobactam)	10	0.5%	9	0.5%	1	0.9%	0	0.0%
J01CR (Combinations of penicillins, incl. beta-lactamase inhibitors)	497	24.0%	464	26.6%	21	18.9%	2	1.1%
J01CR02 (Amoxicillin and enzyme inhibitor)	176	8.5%	150	8.6%	20	18.0%	1	0.5%
J01CR05 (Piperacillin and enzyme inhibitor)	321	15.5%	314	18.0%	1	0.9%	1	0.5%
J01DB (First-generation cephalosporins)	21	1.0%	9	0.5%	0	0.0%	12	6.5%
J01DB01 (Cefalexin)	19	0.9%	7	0.4%	0	0.0%	12	6.5%
J01DB04 (Cefazolin)	2	0.1%	2	0.1%	0	0.0%	0	0.0%
J01DC (Second-generation cephalosporins)	28	1.4%	1	0.1%	27	24.3%	0	0.0%
J01DC02 (Cefuroxime)	28	1.4%	1	0.1%	27	24.3%	0	0.0%
J01DD (Third-generation cephalosporins)	36	1.7%	35	2.0%	0	0.0%	0	0.0%
J01DD01 (Cefotaxime)	8	0.4%	8	0.5%	0	0.0%	0	0.0%
J01DD02 (Ceftazidime)	2	0.1%	2	0.1%	0	0.0%	0	0.0%
J01DD04 (Ceftriaxone)	25	1.2%	25	1.4%	0	0.0%	0	0.0%
J01DD08 (Cefixime)	1	0.0%	0	0.0%	0	0.0%	0	0.0%
J01DF (Monobactams)	16	0.8%	16	0.9%	0	0.0%	0	0.0%
J01DF01 (Aztreonam)	16	0.8%	16	0.9%	0	0.0%	0	0.0%
J01DH (Carbapenems)	81	3.9%	78	4.5%	1	0.9%	0	0.0%
J01DH02 (Meropenem)	75	3.6%	72	4.1%	1	0.9%	0	0.0%
J01DH03 (Ertapenem)	5	0.2%	5	0.3%	0	0.0%	0	0.0%
J01DH51 (Imipenem and enzyme inhibitor)	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J01EA (Trimethoprim and derivatives)	28	1.4%	24	1.4%	0	0.0%	4	2.2%
J01EA01 (Trimethoprim)	28	1.4%	24	1.4%	0	0.0%	4	2.2%
J01EC (Intermediate-acting sulfonamides)	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J01EC02 (Sulfadiazine)	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J01EE (Combinations of sulfonamides and trimethoprim, incl. derivatives)	58	2.8%	5	0.3%	0	0.0%	51	27.7%
J01EE01 (Sulfamethoxazole and trimethoprim)	58	2.8%	5	0.3%	0	0.0%	51	27.7%

Appendix B Table IV (part 2) 2017

Table IV. Antimicrobial agents (ATC4 and ATC5) by indication								
Page 2 of 2	Total UK-NI (n=16)							
	Total	%	Trt	%	SP	%	MP	%
J01FA (Macrolides)	117	5.6%	95	5.5%	1	0.9%	17	9.2%
J01FA01 (Erythromycin)	6	0.3%	1	0.1%	0	0.0%	1	0.5%
J01FA09 (Clarithromycin)	92	4.4%	91	5.2%	1	0.9%	0	0.0%
J01FA10 (Azithromycin)	19	0.9%	3	0.2%	0	0.0%	16	8.7%
J01FF (Lincosamides)	19	0.9%	18	1.0%	1	0.9%	0	0.0%
J01FF01 (Clindamycin)	19	0.9%	18	1.0%	1	0.9%	0	0.0%
J01GB (Aminoglycosides)	153	7.4%	129	7.4%	21	18.9%	3	1.6%
J01GB01 (Tobramycin)	10	0.5%	10	0.6%	0	0.0%	0	0.0%
J01GB03 (Gentamicin)	139	6.7%	115	6.6%	21	18.9%	3	1.6%
J01GB05 (Neomycin (injection, infusion))	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J01GB06 (Amikacin)	3	0.1%	3	0.2%	0	0.0%	0	0.0%
J01MA (Fluoroquinolones)	91	4.4%	84	4.8%	0	0.0%	7	3.8%
J01MA02 (Ciprofloxacin)	75	3.6%	68	3.9%	0	0.0%	7	3.8%
J01MA12 (Levofloxacin)	16	0.8%	16	0.9%	0	0.0%	0	0.0%
J01RA (Combinations of antibacterials)	7	0.3%	1	0.1%	0	0.0%	6	3.3%
J01RA02 (Sulfonamides, combinations with other antibacterials (excl. trimethoprim)	7	0.3%	1	0.1%	0	0.0%	6	3.3%
J01XA (Glycopeptide antibacterials)	120	5.8%	109	6.3%	11	9.9%	0	0.0%
J01XA01 (Vancomycin (parenteral))	27	1.3%	27	1.5%	0	0.0%	0	0.0%
J01XA02 (Teicoplanin)	93	4.5%	82	4.7%	11	9.9%	0	0.0%
J01XB (Polymyxins)	6	0.3%	3	0.2%	0	0.0%	3	1.6%
J01XB01 (Colistin (injection, infusion))	6	0.3%	3	0.2%	0	0.0%	3	1.6%
J01XC (Steroid antibacterials)	5	0.2%	5	0.3%	0	0.0%	0	0.0%
J01XC01 (Fusidic acid)	5	0.2%	5	0.3%	0	0.0%	0	0.0%
J01XD (Imidazole derivatives)	105	5.1%	96	5.5%	9	8.1%	0	0.0%
J01XD01 (Metronidazole (parenteral))	105	5.1%	96	5.5%	9	8.1%	0	0.0%
J01XE (Nitrofuran derivatives)	20	1.0%	13	0.7%	0	0.0%	7	3.8%
J01XE01 (Nitrofurantoin)	20	1.0%	13	0.7%	0	0.0%	7	3.8%
J01XX (Other antibacterials)	26	1.3%	26	1.5%	0	0.0%	0	0.0%
J01XX01 (Fosfomycin)	2	0.1%	2	0.1%	0	0.0%	0	0.0%
J01XX08 (Linezolid)	14	0.7%	14	0.8%	0	0.0%	0	0.0%
J01XX09 (Daptomycin)	8	0.4%	8	0.5%	0	0.0%	0	0.0%
J01XX10 (Bacitracin)	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J01XX11 (Tedizolid)	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J02AA (Antimycotics, antibiotics)	9	0.4%	3	0.2%	0	0.0%	6	3.3%
J02AA01 (Amphotericin B (parenteral))	9	0.4%	3	0.2%	0	0.0%	6	3.3%
J02AC (Triazole derivatives)	28	1.4%	20	1.1%	1	0.9%	7	3.8%
J02AC01 (Fluconazole)	23	1.1%	20	1.1%	1	0.9%	2	1.1%
J02AC02 (Itraconazole)	2	0.1%	0	0.0%	0	0.0%	2	1.1%
J02AC03 (Voriconazole)	1	0.0%	0	0.0%	0	0.0%	1	0.5%
J02AC04 (Posaconazole)	2	0.1%	0	0.0%	0	0.0%	2	1.1%
J02AX (Other antimycotics for systemic use)	16	0.8%	14	0.8%	0	0.0%	1	0.5%
J02AX01 (Flucytosine)	1	0.0%	1	0.1%	0	0.0%	0	0.0%
J02AX04 (Caspofungin)	1	0.0%	0	0.0%	0	0.0%	1	0.5%
J02AX05 (Micafungin)	2	0.1%	2	0.1%	0	0.0%	0	0.0%
J02AX06 (Anidulafungin)	12	0.6%	11	0.6%	0	0.0%	0	0.0%
J04AB (Antimycobacterials, antibiotics)	11	0.5%	11	0.6%	0	0.0%	0	0.0%
J04AB02 (Rifampicin)	11	0.5%	11	0.6%	0	0.0%	0	0.0%
P01AB (Nitroimidazole derivatives)	48	2.3%	45	2.6%	1	0.9%	0	0.0%
P01AB01 (Metronidazole (oral, rectal))	48	2.3%	45	2.6%	1	0.9%	0	0.0%
LEGEND:								
Trt: treatment intention, SP: surgical prophylaxis, MP: medical prophylaxis								

Appendix B Table V (2017)

Table V. Antimicrobial treatment diagnosis site by indication								
	Total UK-NI (n=16)							
	Total	%	CI	%	HI	%	LI	%
Total N of diagnoses (N of infections)	1249	100.0%	895	100.0%	326	100.0%	28	100.0%
Respiratory tract	446	35.7%	312	34.9%	124	38.0%	10	35.7%
PNEU (Pneumonia)	343	27.5%	222	24.8%	113	34.7%	8	28.6%
BRON (Acute bronchitis or exacerberations of chronic bronchitis)	94	7.5%	81	9.1%	11	3.4%	2	7.1%
CF (Cystic Fibrosis)	9	0.7%	9	1.0%	0	0.0%	0	0.0%
Urinary tract	179	14.3%	143	16.0%	30	9.2%	6	21.4%
CYS (Symptomatic Lower UTI)	109	8.7%	85	9.5%	18	5.5%	6	21.4%
PYE (Symptomatic Upper UTI)	68	5.4%	57	6.4%	11	3.4%	0	0.0%
ASB (Asymptomatic bactreriuria)	2	0.2%	1	0.1%	1	0.3%	0	0.0%
Systemic infections	180	14.4%	126	14.1%	48	14.7%	6	21.4%
BAC (Lab-confirmed bacteraemia)	57	4.6%	39	4.4%	17	5.2%	1	3.6%
CSEP (Clinical sepsis (suspected bloodstream infections without lab confirmation=result not yet available, no blood cultures collect	52	4.2%	34	3.8%	17	5.2%	1	3.6%
FN (Febrile Neutropaenia or other form of manifestation of infection in immunocompromised host (e.g., HIV, chemotherapy etc)	29	2.3%	26	2.9%	3	0.9%	0	0.0%
SIRS (Systematic inflammatory response with no clear anatomic site)	27	2.2%	16	1.8%	9	2.8%	2	7.1%
UND (Completely undefined, site with no systemic inflammation)	15	1.2%	11	1.2%	2	0.6%	2	7.1%
Cardiovascular system	11	0.9%	9	1.0%	1	0.3%	1	3.6%
Gastro-intestinal system	179	14.3%	133	14.9%	45	13.8%	1	3.6%
GI (GI Infections (salmonellosis, antibiotic associated diarrhoea))	36	2.9%	13	1.5%	23	7.1%	0	0.0%
IA (Intra abdominal sepsis including hepatobiliary)	143	11.4%	120	13.4%	22	6.7%	1	3.6%
Skin/soft tissue/bone/joint - SSI	41	3.3%	9	1.0%	32	9.8%	0	0.0%
SST-SSI (Surgical site infection involving skin or soft tissue but not bone)	27	2.2%	3	0.3%	24	7.4%	0	0.0%
BJ-SSI (Septic arthritis, osteomyelitis of surgical site)	14	1.1%	6	0.7%	8	2.5%	0	0.0%
Skin/soft tissue/bone/joint - other	128	10.2%	106	11.8%	18	5.5%	4	14.3%
SST-O (Cellulitis, wound, deep soft tissue not involving bone, not related to surgery)	103	8.2%	84	9.4%	17	5.2%	2	7.1%
BJ-O (Septic arthritis, osteomyelitis, not related to surgery)	25	2.0%	22	2.5%	1	0.3%	2	7.1%
Central nervous system	21	1.7%	17	1.9%	4	1.2%	0	0.0%
Eye/ear/nose/throat	51	4.1%	30	3.4%	21	6.4%	0	0.0%
Genito-urinary system/obs.	13	1.0%	10	1.1%	3	0.9%	0	0.0%
OBGY (Obstetric or gynaelogical infections, STD in women)	9	0.7%	6	0.7%	3	0.9%	0	0.0%
GUM (Prostatitis, epididymoorchitis, STD in men)	4	0.3%	4	0.4%	0	0.0%	0	0.0%
Missing/Unknown	0	0.0%	0	0.0%	0	0.0%	0	0.0%
LEGEND:								
CI: treatment intention for community-acquired infection								
HI: treatment intention for hospital-acquired infection								
LI: treatment intention for long-term care-acquired infection								

Appendix B Table VI (2017)

Table VI. Distribution of microorganisms isolated in HAI

	Total		PN/LRI(1)		SSI		UTI		BSI(2)		GI(3)	
N of HAI, all	241		77		41		15		24		26	
N of HAI with microorganisms, all	85	35.3%	8	10.4%	16	39.0%	9	60.0%	22	91.7%	20	76.9%
N of microorganisms	99	100.0%	9	100.0%	21	100.0%	10	100.0%	22	100.0%	25	100.0%
GRAM-POSITIVE COCCI	38	38.4%	2	22.2%	12	57.1%	1	10.0%	11	50.0%	5	20.0%
STAPHYLOCOCCUS AUREUS	19	19.2%	2	22.2%	8	38.1%	0	0.0%	6	27.3%	0	0.0%
COAG.-NEG. STAPHYLOCOCCI	5	5.1%	0	0.0%	2	9.5%	0	0.0%	2	9.1%	1	4.0%
STREPTOCOCCUS SPP.	3	3.0%	0	0.0%	1	4.8%	0	0.0%	0	0.0%	1	4.0%
ENTEROCOCCUS SPP.	10	10.1%	0	0.0%	1	4.8%	1	10.0%	2	9.1%	3	12.0%
OTHER GRAM POSITIVE COCCI	1	1.0%	0	0.0%	0	0.0%	0	0.0%	1	4.5%	0	0.0%
ENTEROBACTERIACEAE	31	31.3%	5	55.6%	6	28.6%	8	80.0%	8	36.4%	3	12.0%
ENTEROBACTER SPP.	1	1.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
ESCHERICHIA COLI	21	21.2%	3	33.3%	3	14.3%	7	70.0%	6	27.3%	2	8.0%
KLEBSIELLA SPP.	5	5.1%	1	11.1%	1	4.8%	1	10.0%	1	4.5%	1	4.0%
PROTEUS SPP.	3	3.0%	0	0.0%	2	9.5%	0	0.0%	1	4.5%	0	0.0%
SERRATIA SPP.	1	1.0%	1	11.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
GRAM-NEG., NON-ENTEROBACTERIACEAE	4	4.0%	0	0.0%	1	4.8%	0	0.0%	1	4.5%	0	0.0%
ACINETOBACTER SPP.	1	1.0%	0	0.0%	0	0.0%	0	0.0%	1	4.5%	0	0.0%
PSEUDOMONAS AERUGINOSA	2	2.0%	0	0.0%	1	4.8%	0	0.0%	0	0.0%	0	0.0%
PSEUDOMONADACEAE FAMILY, OTHER	1	1.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
ANAEROBIC BACILLI	19	19.2%	1	11.1%	1	4.8%	1	10.0%	0	0.0%	16	64.0%
BACTEROIDES SPP.	2	2.0%	0	0.0%	1	4.8%	0	0.0%	0	0.0%	1	4.0%
CLOSTRIDIUM DIFFICILE	15	15.2%	0	0.0%	0	0.0%	1	10.0%	0	0.0%	14	56.0%
OTHER ANAEROBES	2	2.0%	1	11.1%	0	0.0%	0	0.0%	0	0.0%	1	4.0%
OTHER BACTERIA	1	1.0%	0	0.0%	1	4.8%	0	0.0%	0	0.0%	0	0.0%
FUNGI	6	6.1%	1	11.1%	0	0.0%	0	0.0%	2	9.1%	1	4.0%
CANDIDA SPP.	4	4.0%	0	0.0%	0	0.0%	0	0.0%	2	9.1%	1	4.0%
OTHER FUNGI OR PARASITES	2	2.0%	1	11.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NEGATIVE CODES(4)	156	64.7%	69	89.6%	25	61.0%	6	40.0%	2	8.3%	6	23.1%
MICRO-ORGANISM NOT IDENTIFIED	18	7.5%	11	14.3%	3	7.3%	0	0.0%	0	0.0%	1	3.8%
EXAMINATION NOT DONE	72	29.9%	28	36.4%	12	29.3%	4	26.7%	0	0.0%	2	7.7%
STERILE EXAMINATION	1	0.4%	0	0.0%	1	2.4%	0	0.0%	0	0.0%	0	0.0%
NOT (YET) AVAILABLE/MISSING	65	27.0%	30	39.0%	9	22.0%	2	13.3%	2	8.3%	3	11.5%

LEGEND:

(1) PN/LRI: pneumonia and other lower respiratory tract infections (incl. PN1-PN5, PN-Nos, NEO-PNEU, LRI-BRON, LRI-LUNG)

(2) BSI: bloodstream infections (incl. BSI, CRI3, NEO-LCBI, NEO-CNSB, NEO-CSEP)

(3) GI: gastro-intestinal infections (incl. GI-CDI, GI-GE, GI-GIT, GI-IAB, GI-Nos, NEO-NEC)

(4) Negative codes: percentage of total HAI

Appendix C Table I (2017)

Device usage across ward specialities 2012 vs. 2017

Ward Speciality	CVC				PVC				UC				Intubated			
	2012		2017		2012		2017		2012		2017		2012		2017	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All Specialties	200	5	207	5.4	1733	43.4	2013	52.8	681	17.1	679	17.8	97	2.4	78	2
Care of the Elderly	3	1.1	2	0.5	74	26.2	123	33.2	47	16.7	54	14.6	0	-	0	0
Adult ICU	42	42.4	55	74.3	68	68.7	57	77	71	71.7	73	98.6	42	42.4	36	48.6
Medical	77	4.6	65	4.1	833	49.4	919	57.5	281	16.7	271	17	10	0.6	2	0.1
Obstetrics/Gynaecology	1	0.3	3	0.9	86	22.3	103	31.3	27	7	37	11.2	5	1.3	0	0
Paediatrics (inc. paediatric & neonatal ICU)	17	9.6	23	20	63	35.4	96	79.8	10	5.6	8	5.2	13	7.3	8	5.9
Surgical	55	5.3	44	4.5	552	53	603	61	226	21.7	203	20.5	27	2.6	29	2.9
Other	5	1.6	15	13.4	57	17.8	112	129.1	19	5.9	33	39.8	0	-	3	4.4
N = number of devices																
% = percentage of patients																

Appendix C Table II (2017)

Distribution of HAI by Gender and Age Group 2012 vs. 2017

Risk Factors	Number of Patients		Number of Patients with HAI		HAI prevalence %(95% CI)	
	2012 (n=3992)	2017 (n=3813)	2012	2017	2012	2017
Gender						
Male	1823	1763	85	135	4.7 (3.8-5.8)	7.7 (6.5-9.0)
Female	2169	2050	81	99	3.7 (3.0-4.6)	4.8 (4.0-5.8)
Age Group						
< 1 month	186	168	3	14	1.6 (1.6-4.6)	8.3 (5.0-13.5)
1-23 months	96	43	8	4	8.3 (4.3-15.6)	9.3 (3.7-21.6)
2-15 years	101	115	2	0	2.0 (0.5-6.9)	0.0 (0.0-3.2)
16-29 years	299	242	6	4	2.0 (0.9-4.3)	1.7 (0.6-4.2)
30-49 years	590	487	18	29	3.1 (1.9-4.8)	6.0 (4.2-8.4)
50-64 years	654	640	38	35	5.8 (4.3-7.9)	5.5 (4.0-7.5)
65-79 years	1092	1116	47	85	4.3 (3.3-5.7)	7.6 (6.2-9.3)
80+ years	974	1002	44	63	4.5 (3.4-6.0)	6.3 (4.9-8.0)

Appendix C Table III (2017)

Distribution of HAI by Hospital Type 2012 vs. 2017

Hospital types	Number of Patients		Number of Patients with HAI		HAI prevalence %(95% CI)	
	2012	2017	2012	2017	2012	2017
Primary	672	663	15	34	2.2 (1.4-3.7)	5.1 (3.7-7.1)
Secondary	1947	1892	62	118	3.2 (2.6-4.2)	6.2 (5.2-7.4)
Tertiary	952	858	65	59	6.8 (5.8-9.2)	6.9 (5.4-8.8)
Specialised	421	400	24	23	5.7 (4.1-8.8)	5.8 (3.9-8.5)

Appendix C Table IV (2017)

Distribution of HAI by Risk Factors (Invasive device, Surgery, Underlying disease prognosis) 2012 vs. 2017

Risk Factors	Number of Patients		Number of Patients with HAI		HAI prevalence %(95% CI)	
	2012 (n=3992)	2017 (n=3813)	2012	2017	2012	2017
Invasive device in situ						
Any device - Yes	2034	2298	145	194	7.1 (6.1-8.3)	8.4 (7.4-9.6)
Any device - No	1958	1515	21	40	1.1 (0.7-1.6)	2.6 (1.9-3.6)
CVC	200	207	41	31	20.5 (15.5-26.6)	14.9 (10.8-20.5)
PVC	1733	2013	110	174	6.3 (5.3-7.6)	8.6 (7.5-10.0)
Urinary Catheter	681	679	64	85	9.4 (7.4-11.8)	12.5 (10.2-15.2)
Intubulation	97	78	16	9	16.5 (10.4-25.1)	11.5 (6.2-20.5)
Surgery Since Admission						
Yes	706	632	55	71	7.8 (6.0-10.0)	11.2 (9.0-13.9)
No	3286	3181	111	163	3.4 (2.8-4.1)	5.1 (4.4-5.9)
Underlying Disease Prognosis						
None/Non-fatal	2792	2477	83	139	3.0 (2.4-3.7)	5.6 (4.8-6.6)
Life Limiting Prognosis	844	735	59	57	7.0 (5.5-8.9)	7.8 (6.0-9.9)
End of life Prognosis	109	182	9	15	8.3 (4.4 - 15.0)	8.2 (5.1-13.2)
Not Known	247	419	15	23	6.1 (3.7-9.8)	5.5 (3.7-8.1)

Appendix C Table V (2017)

Distribution of HAI by Ward Speciality 2012 vs. 2017

Ward Specialty	Number		% Total Patients		Number with HAI		HAI Prevalence %(95% CI)	
	2012	2017	2012	2017	2012	2017	2012	2017
All Ward Specialities	3992	3813	100	100	166	234	4.2 (3.6-4.8)	6.14 (5.4-6.9)
Adult ICU	99	74	2.5	1.9	9	13	9.1 (4.7-16.4)	17.6 (10.6-27.8)
Care of the Elderly	282	371	7.1	9.7	16	28	5.7 (3.5-9.0)	7.5 (5.3-10.7)
Surgical	1041	988	26.1	25.9	54	65	5.2 (4.0-6.7)	6.6 (5.2-8.3)
Paediatrics (Inc. pardiatric & neonatal ICUs)	178	227	4.5	5.6	8	16	4.5 (2.3-8.6)	7.0 (4.4-11.1)
Medical	1687	1597	42.3	41.9	67	87	4.0 (3.1-5.0)	5.4 (4.4-6.7)
Other	320	227	8	5.6	9	10	2.8 (1.5-5.3)	4.4 (2.4-7.9)
Obstetrics/Gynaecology	385	329	9.6	8.6	3	15	0.8 (0.3-2.3)	4.6 (2.8-7.4)