NATIONAL SEPSIS REPORT **2019**

Clinical Design and Innovation

RECOGNISE SEPSIS • ENHANCE SURVIVAL •

September 2020

National Sepsis Outcome Report 2019

Dear Colleagues,

This is the fifth National Sepsis Outcome Report describing the burden of sepsis on the Irish healthcare system, in terms of the number of cases and the associated mortality. Understanding the pattern of sepsis incidence in Ireland is essential to inform us on the characteristics of individuals who are at increased risk both of developing sepsis and of dying from sepsis. This allows us to have heightened vigilance for sepsis amongst these individuals and provides evidence to support the use of preventative strategies, such as vaccination, in these at-risk people. While sepsis occurs in all age groups and all sectors of society, it most commonly occurs in the extremes of age and in individuals with co-morbidities.

The most effective way to reduce mortality from sepsis is by prevention, with good sanitation, personal hygiene, healthy eating, exercising moderately, breast feeding, avoiding unnecessary antibiotics and vaccination for vaccine preventable infections.

The next most effective way is early recognition and treatment.

Five processes must occur to give the patient the best opportunity to survive:

i) The unwell person, their family or carer must be aware of the signs and symptoms of sepsis and the need to seek early medical review.
ii) Early recognition at point of presentation or deterioration.
iii) Escalate to medical review to ensure that a thorough history and examination is carried out to identify infection as the likely (or suspected cause) of the patient being unwell and either detecting new onset organ dysfunction consequent to that infection or identifying that the patient is in a group that puts them at an increased risk of developing and indeed dying from sepsis.
iv) The patient is treated with the Sepsis 6, which includes blood tests being sent to assess organ function.
v) Review the patient's response to initial therapy with the results of further clinical examination, and the available tests and investigations and amend the treatment plan accordingly.

This report outlines the status of sepsis in Ireland in 2019 based on data extracted from the hospital inpatient enquiry (HIPE) dataset. All datasets have limitations and are dependent on methodologies used to identify and extract data. The strengths in this report include the education of the acute healthcare sector and the coders in a standardised approach to assessment and documentation of sepsis and using a consistent dataset. Due to the COVID –

19 Pandemic and resulting strain on resources to extract and analyse the data, this report uses last year's HIPE data where no significant differences were noted over the previous years.

We acknowledge the change in sepsis definition that excludes the systemic inflammatory response to infection without organ dysfunction (R65.0) in the suite of sepsis diagnosis. R65.0 is now excluded from this report.

The report shows that there has been a 3% decrease in associated in-hospital mortality rate in adult, non-maternity cohort in comparison to the 2018 data (20.3% vs 19.7%). This decrease is welcome in the context of the requirement for organ dysfunction to diagnose sepsis. These individuals are invariably a higher acuity cohort and it may be expected that their mortality rate is higher than for those coded as sepsis using the previous criteria i.e. SIRS response to infection.

The outcomes in this report are the result of the hard work and dedication of the staff caring for sick people in our acute healthcare sector and recognition must be given to the improvements that they have achieved through their willingness to engage in this quality improvement (Q.I.) programme. Each hospital's sepsis Q.I. project was coordinated by their Sepsis Committee, which in many included a dedicated Sepsis Nurse, who took on these additional responsibilities. Credit also to the Group Sepsis Assistant Directors of Nursing who provided awareness, education, and painstaking audit to feedback to the Hospitals, Hospital Groups and to inform National data so that the ongoing education efforts could be strengthened. We welcome the addition of a Sepsis ADON for the Children's Hospital Group and look forward to presenting the epidemiology of sepsis for children in Ireland in subsequent National Reports.

Thanks also to the coders for their hard work and it is our intention to run further sepsis coding workshops in 2021. We would also like to thank the members of the Audit subcommittee (Appendix 1) who include the Healthcare Pricing Office, the Office of Coding and indeed our statistician, Gráinne Cosgrove from the Quality Improvement Directorate, without whom this report would not be possible. Also, thank you to Ciara Hughes, Programme Manager, for her dedicated work that positively impacted on the success of the programme. The National Sepsis Programme is overseen by the National Sepsis Steering Committee (Appendix 2) and effected through the National Sepsis Team (Appendix 3). The codes used for this analysis are outlined in Appendix 4.

Go raibh mile maith agat,

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National Sepsis Lead, HSE Clinical Design and Innovation,

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Key findings

The following figures include adult, maternity, and paediatric patients.

Total number of cases Sepsis, septic shock cases, 2019	13,930
Crude mortality rate, 2019	18.4%

The following relate to the adult, non-maternity patient.

Number of cases of Sepsis & Septic Shock	12,908
In-hospital mortality rate: Sepsis & Septic Shock	19.7%
Average length of stay	22.9 days

Specialty based data:

Paediatric sepsis-associated hospital mortality rate	3.7%
Maternal sepsis-associated hospital mortality rate	0%
Surgical DRG sepsis-associated hospital mortality rate	24.5%
Medical DRG sepsis-associated hospital mortality rate	18.7%

Key comparators with 2018 (adult non-maternity cohort)

Mortality: There was an 11.8% decrease in documented cases of Sepsis and Septic Shock with a 2.9% decrease in associated in-hospital mortality rate. There was a 5% increase on average length of stay.

Sepsis: There were 11,819 cases documented in 2019, a 12.7% decrease when compared with 2018 (n=13,547), with an in-hospital mortality of 18.1%, representing a 2.6% decrease in mortality over 2018 (n=18.6%). This benchmarks well internationally: UK 20.3%[1], USA 25%[2], Australia 19.7%[3] and Globally 27%[4].

Septic Shock: There were 1,089 cases documented in 2019, a 0.27% decrease when compared with 2018 (n=1092), with an in-hospital mortality of 37%, representing an 11% decrease in mortality when compared with 2018 (n=41.6%). This also benchmarks well internationally: Australia 23.9%[3] and Globally 42%[4].

Key Findings 2019 vs 2018:

% Change in age-adjusted mortality since 2018 ↓ 2.9%

% Change in age-adjusted mortality since 2014 ↓ 11.3%

% Change in age-adjusted mortality since 2011 ↓ 26.5%

It is also important to note that the actual number of deaths from Sepsis dropped from 3,004 in 2017 when we first see the effects in the change in definition, to 2,542 in 2019.

Key Recommendations

1	Development of a sepsis mortality prediction model and scoring system to compare age and co-morbidity adjusted hospital sepsis-associated mortality rates nationally and internationally.
2	Continued support for the sepsis quality improvement programme at a national level and for the hospital sepsis/deteriorating patient committees.
3	Adoption of the Surviving Sepsis Campaign International Guidelines for the Management of Septic Shock and Sepsis-Associated Organ Dysfunction in Children (SSCGC 2020), and provision of an implementation plan to guide its implementation in the Irish context.
4	Provision of an eLearning programme for all healthcare professionals involved in the care of children with sepsis and suspicion of sepsis, working in the acute healthcare sector.
5	Continued education of clinicians and HIPE coders in the new definition with emphasis on documentation of infection and associated organ dysfunction.
6	Continued emphasis on awareness and education to the general public and in primary and community care about sepsis.

National Sepsis Report 2019

An overview of the burden of sepsis-associated mortality and healthcare usage (2011-2019), as captured by the Hospital In-Patient Enquiry database (HIPE).

HIPE dataset

The data captured in this dataset is dependent on the documentation in the patients' medical notes and its' coding. An external, independent body reviewed the quality of coding in 2016 and the subsequent report is available at www.hpo.ie.

The National Sepsis Programme provides clinical decision support tools, the Sepsis Forms, that facilitate diagnosis and correct risk stratification, from which coders can code, providing a medical professional has signed the form.

Population studied

ICD–10–AM Diagnosis codes were used to identify patients with sepsis (Appendix 4a) and infection (Appendix 4b). In 2015, the 8th edition of ICD-10-AM was introduced, and this includes new codes:

R57.2 Septic Shock

R65.1 Systemic inflammatory response syndrome (SIRS) of infectious origin with acute organ failure (sepsis)

The inclusion of these new codes means the datasets analysed pre- and post-2015 are not identical. Furthermore, in 2016, the latest definition of sepsis, Sepsis-3, excludes R65.0, SIRS of infectious origin without organ failure. For this reason, ***R65.0*** *has not been included in this report. This needs to be taken into consideration when interpreting trends over the past 5 years.*

These codes were interrogated in patients aged 16 + in the acute hospital sector. Maternity patients with sepsis, identified by maternity specific codes (Appendix 4c), were excluded as they are subject to analysis and reporting by Maternal Death Enquiry Ireland (National Perinatal Epidemiology Centre).

Paediatric sepsis reporting will be included in next year's annual report and coding will reflect the International Surviving Sepsis Campaign Guideline for Children (2020).

Limitations

Administrative databases are limited to what is documented in the patients' case notes (The Coding Process, Appendix 4).

In order to severity-adjust for limited benchmarking, the surrogate of 'patients with a diagnosis of sepsis and critical care admission' was used. Critical care requirement was identified by admission to CCU, HDU, ICU or an Intensive Care Consultant code. The advantage is that it includes critically ill patients where there was 'an intention to treat', and some limited comparison with critical care databases can be done. The disadvantages are that it assumes that there is always a critical care bed available and it fails to take into account that patients admitted to critical care are a heterogeneous group varying from requiring modest respiratory or cardiovascular support with a lower mortality predictive score to multi-organ failure and a high score.

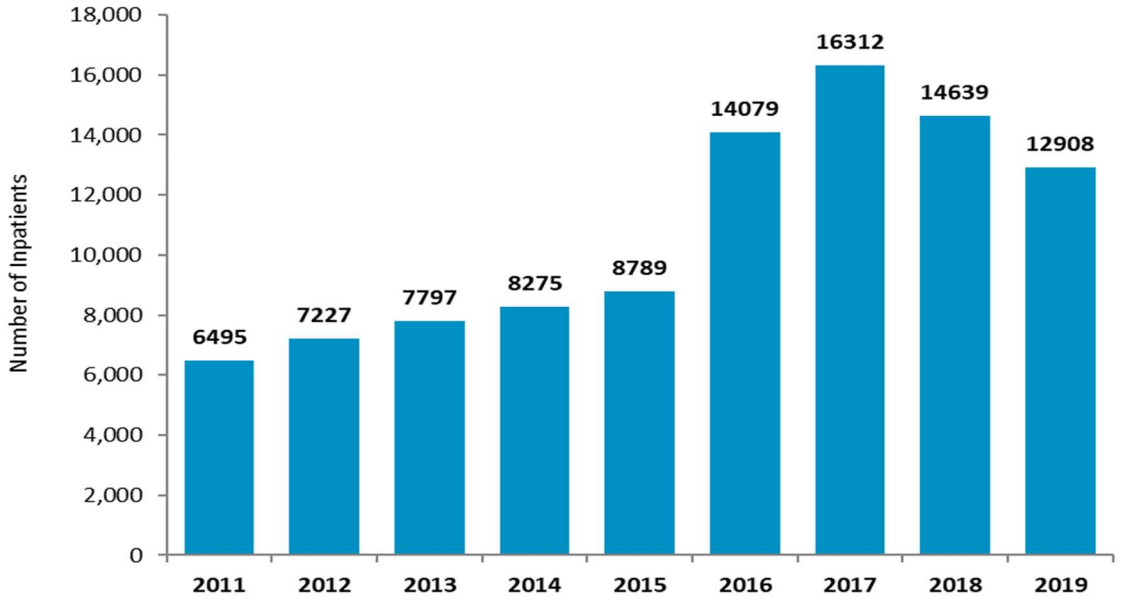
This current analysis provides age-adjusted mortality rates and provides an insight into the burden of sepsis in our healthcare system. Both age and co-morbidities are strongly

associated with higher mortality from sepsis. Sex difference in sepsis incidence occurs but not in mortality. Based on the current analysis, the requirement to develop and validate a sepsis mortality prediction model and an associated mortality prediction score for the HIPE database remains and has been highlighted again in key recommendations.

The data presented in this report are based on inpatients in publicly funded acute hospitals with the diagnosis of sepsis coded on the HIPE system. Causality cannot be inferred, as sepsis may be one of many diagnoses that complicated the patients' admission. Thus, mortality rates reported are sepsis-associated and include both direct and indirect deaths due to sepsis.

The Epidemiology of Sepsis in Ireland

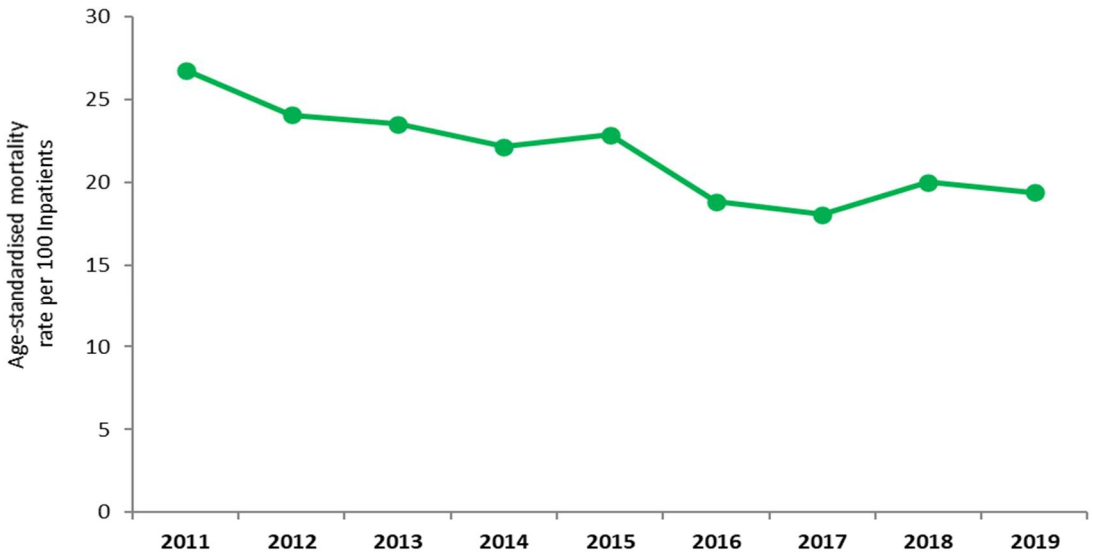
Figure 1: The number of adult patients with a diagnosis of Sepsis & Septic Shock, 2011- 2019 (excludes paediatric and maternity).



Between 2011 and 2015 sepsis cases were increasing by approximately 7% per annum. In 2015, there was a nationwide education campaign as part of the implementation programme of the 2014 National Clinical Guideline No.6: Sepsis Management. This resulted in a 60% increase in the recognition and documentation of sepsis cases. The effect of ongoing sepsis awareness education is reflected in the increase in cases documented since 2015 (Figure 1).

Sepsis-3 definitions identify a cohort of patients with a higher acuity than previously documented as sepsis. It is reasonable to expect a lower number of cases in this cohort with a higher mortality. In Ireland, the effect can be seen in the decrease in cases documented between 2017 and 2019 (Figure 1) and the slight increase in mortality since 2017 (Figure 2).

Figure 2: Age-standardised hospital mortality rate for adult inpatients with a diagnosis of Sepsis, 2011 – 2019.



High risk cohort

Risk stratification and prognosis in sepsis is important because high-risk patients may benefit from earlier clinical interventions, whereas low-risk patients may benefit from not undergoing unnecessary procedures[5]. Chronic comorbid conditions that alter immune function include chronic renal failure, diabetes mellitus, HIV and alcohol abuse, and cumulative comorbidities are associated with greater acute organ dysfunction[6].

Co-morbidities and Sepsis in Ireland

In previous process audits carried out across the acute hospital setting in Ireland, the average age of patients with sepsis was mid-seventies and they had at least 2 co-morbidities. The following figures and tables outline the effects of age and co-morbidity on sepsis incidence and mortality in Ireland.

Figure 3: The number of adult patients with a diagnosis of sepsis by age group

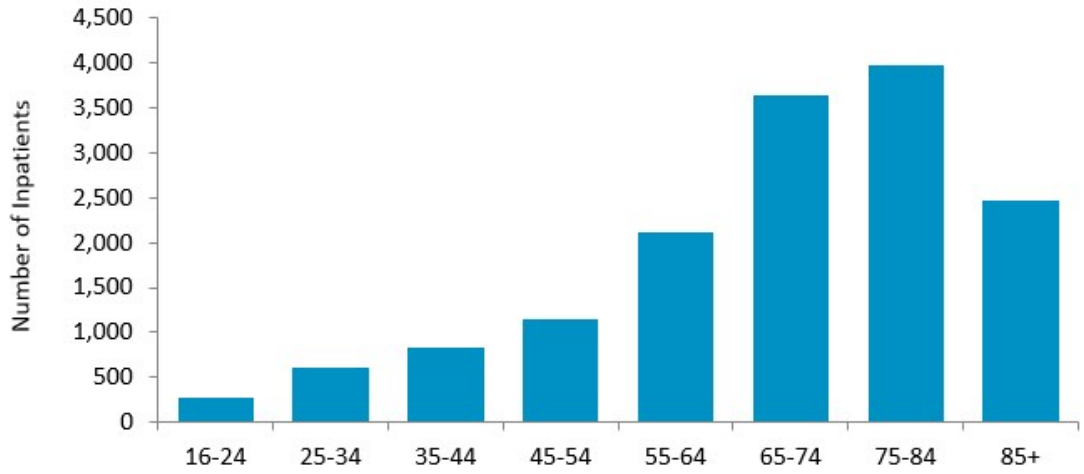
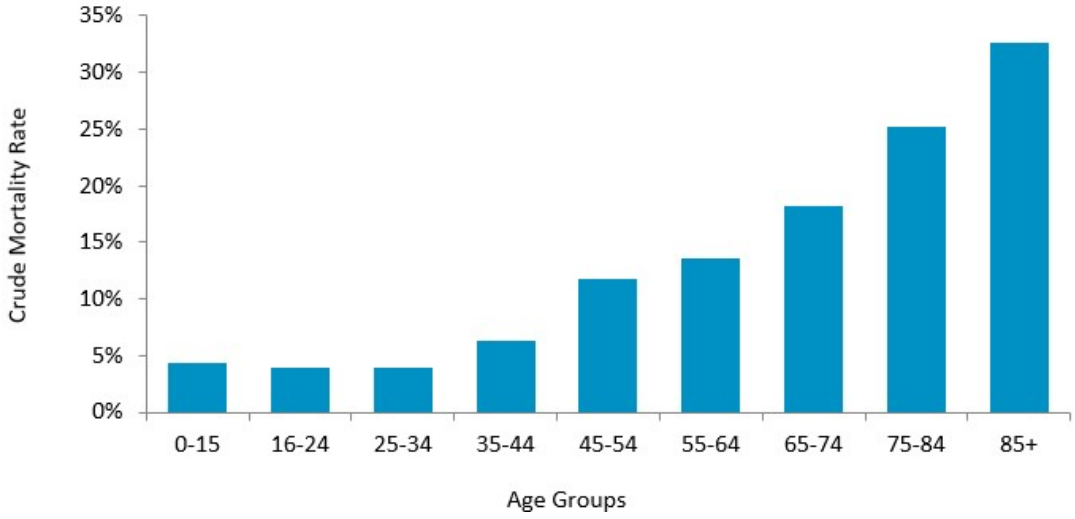


Figure 4: In-hospital mortality for inpatients with a diagnosis of sepsis by age groups.



Whilst sepsis incidence increases with age in adults (Figure 3), mortality peaks at the extremes of age (Figure 4). The majority of paediatric morbidity and mortality occurs in the under ones when the immune system is immature, and with ageing co-morbidities are accumulated and the immune system gradually deteriorates leading to increases in both incidence and mortality.

Table 1: Inpatients with a diagnosis of sepsis and selected co-morbidities; Number of cases and crude mortality rates.

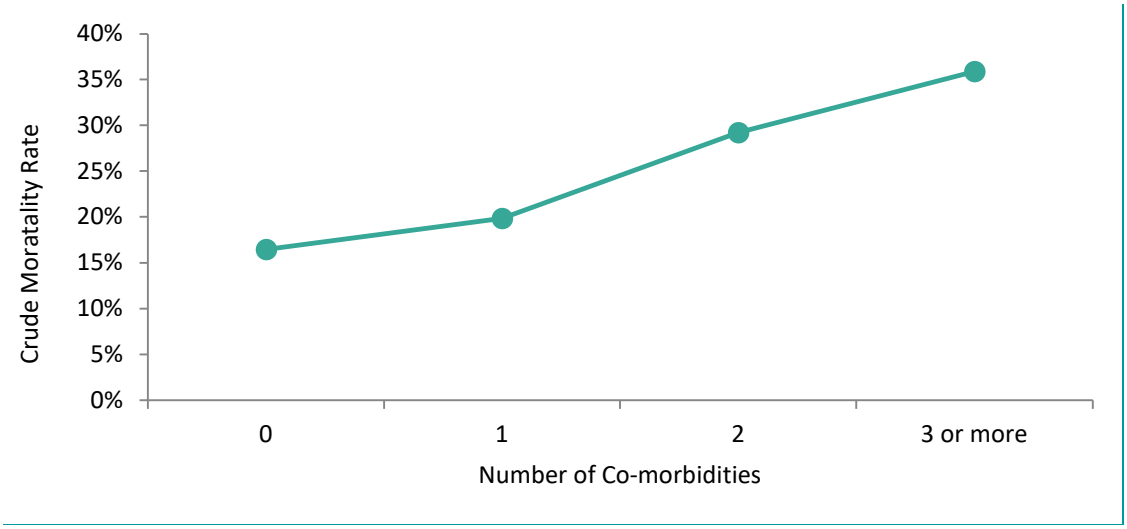
Co-morbidity	Number of cases	Crude Mortality Rate %
Chronic Liver Disease	507	41.5%
Chronic Kidney Disease	2,130	28.6%
Mental & Behavioural Disorders due to Alcohol	603	27.7%
Chronic Obstructive Pulmonary Disease	2,023	26.5%
Diabetes	3, 152	23.3%
Cancer	3,376	21.3%
HIV Disease	28	7.1%

Effect of Recent Surgery on morbidity and mortality

Previous national process audits carried out across the acute hospitals, identified that medical and surgical sepsis patients have similar co-morbidities and that in terms of timely treatment with antimicrobials there was little difference between the 2 cohorts. Thus it can be inferred that the difference in mortality between the medical and surgical cohorts (18.7% vs 24.5%) is not due to issues related to recognition and management, but rather inherent in the circumstances of the patient, the immunosuppressant effect of surgery and the different microorganisms and sites of infection that affect these patients. This data is widely replicated in other jurisdictions.

Given this higher mortality risk extra vigilance should be given to surgical patients who develop signs of infection. For this reason, recent surgery is considered to be a co-morbidity.

Figure 5: The in-hospital mortality rate for adult inpatients with a diagnosis of sepsis and selected co-morbidities



The more co-morbidities the higher the mortality risk (Figure 5). Therefore, extra vigilance should be given to patients who develop signs of infection and who have one or more co-morbidities.

Sepsis-associated mortality, 2011-2019

Table 2: Adult inpatients (non-maternity) with a diagnosis of Sepsis, crude, and age-standardised mortality rates, 2011-2019.

Year	Number of Inpatients with a Diagnosis of Sepsis	Number of Deaths among Inpatients with a Diagnosis of Sepsis	Crude Mortality Rate per 100 Inpatients	Age-standardised Mortality Rate per 100 Inpatients*
2011	6,495	1,686	26.0	26.8
2012	7,227	1,720	23.8	24.1
2013	7,797	1,799	23.1	23.5
2014	8,275	1,821	22.0	22.2
2015	8,789	2,010	22.9	22.9
2016	14,079	2,676	19.0	18.8
2017	16,312	3,004	18.4	18.1
2018	14,639	2,979	20.3	20.0
2019	12,908	2,542	19.7	19.4

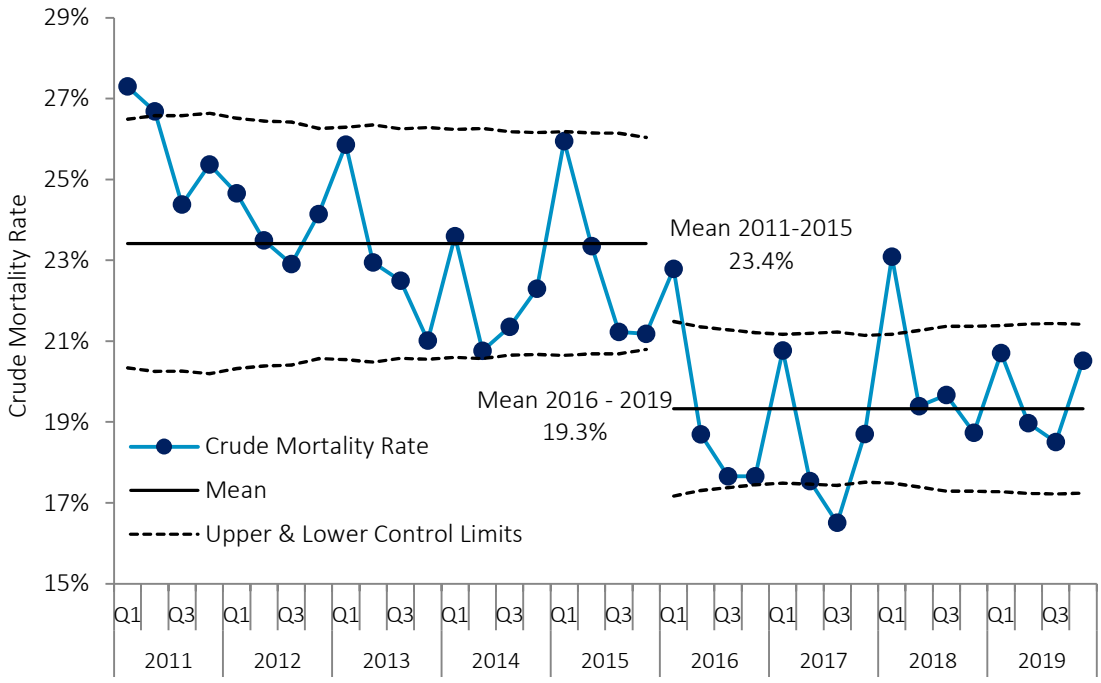
* Data have been age-standardised using a standard population based on the numbers of inpatients with a diagnosis of sepsis in 2015

Sepsis-associated mortality, 2019

Table 3: Incidence of and crude mortality rates for sepsis and septic shock, in adult non-maternity inpatients, 2019

	Number of Cases	Crude Mortality Rate
Sepsis	11,819	18.1%
Septic Shock	1,089	37.0%
Total	**12,908**	**19.7%**

Figure 6: Quarterly rates of in-hospital mortality for adult patients with a diagnosis of Sepsis, quarterly data, 2011 – 2019.



Quarterly rates of in-hospital mortality for inpatients with a diagnosis of sepsis from 2011 to 2019 were analysed using statistical process control (SPC) methods (Figure 6). The use of SPC methods allows us to see whether the changes we made resulted in improvements and allow us to distinguish between variation that may have happened by chance alone and variation that indicates a real improvement in mortality rates.

The mean in-hospital crude mortality rate for inpatients with a diagnosis of sepsis from 2011- 2015 showed an average of 23.4%. Using control limits based on SPC methods it was expected during this period that the quarterly mortality rate would vary from around 20 to 26% by chance alone. The quarterly mortality rate has averaged 19.3% and has been below this lower control limit of 20% since 2016 indicating an improvement in mortality rates that is not explained by chance alone.

The control limits in the SPC chart have been re-calculated to reflect this reduction. We can now expect that this improvement will be sustained, and mortality will remain below 20% (with some variation due to seasonal effects).

It is not possible to distinguish what portion of improvement is due to improved recognition and what is due to improved management. However, process audits on management are performed in each hospital to inform their in-house Q.I. projects.

Table 4: Adult inpatients (non-maternity) with a diagnosis of sepsis, 2017-2019

Diagnosis	2017			2018			2019		
	No. of Inpatients	No. of Deaths	Crude Mortality Rate	No. of Inpatients	No. of Deaths	Crude Mortality Rate	No. of Inpatients	No. of Deaths	Crude Mortality Rate
Sepsis	15,314	2,613	17.1%	13,547	2,525	18.6%	11,819	2,139	18.1%
Septic Shock	971	391	40.3%	1,092	454	41.6%	1,089	403	37.0%
Total	**16,312**	**3,004**	**18.4%**	**14,639**	**2,979**	**20.3%**	**12,908**	**2,542**	**19.7%**

SEASONAL VARIATION

Peaks in mortality occur in the winter season corresponding with the higher incidence of respiratory tract infections, a number of which are vaccine preventable. This report clearly demonstrates the vulnerability of the older patient and those with co-morbidities to sepsis and it is recommended that this cohort avail of vaccination as prevention is always better than cure and cure is not always possible even with the very best management.

Specialties:

Paediatrics and Maternity

The paediatric sepsis form was developed to help support clinicians in the recognition and management of sepsis in children and will be rolled out nationally in 2021.

The maternity sepsis form has been rolled out nationally and the maternal electronic healthcare record has been updated to reflect it.

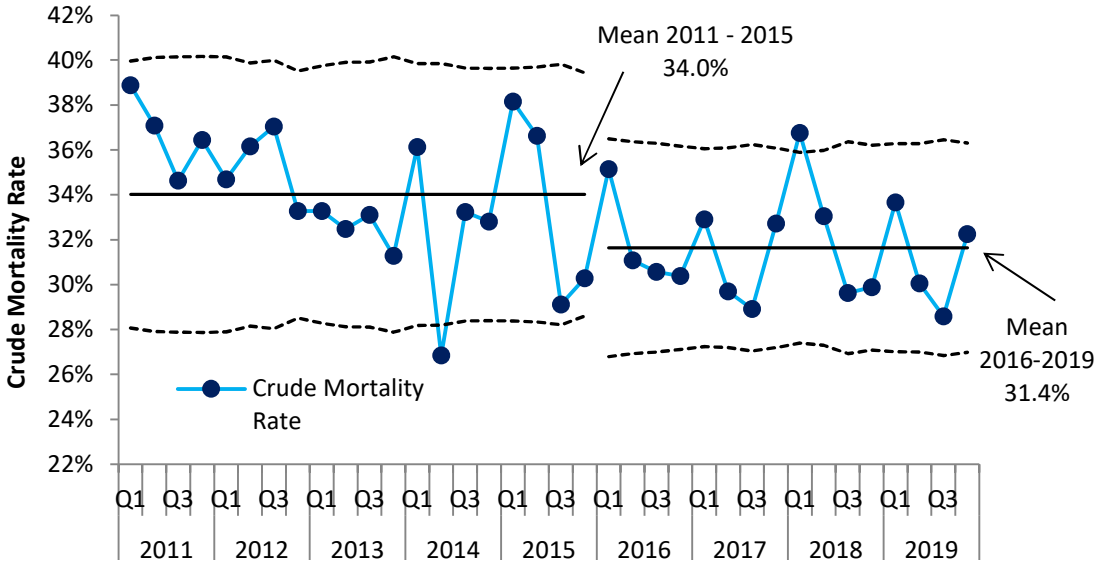
Table 5: Paediatric and maternal sepsis-associated incidence and crude mortality rates, 2011-2019.

Year	Children aged 0-15 Years with a Diagnosis of Sepsis		Pregnancy Related Cases with a Diagnosis of Sepsis	
	Number of Inpatients	Crude Mortality Rate	Number of Inpatients	Crude Mortality Rate
2011	737	3.0%	190	1.6%
2012	763	3.9%	192	0.5%
2013	763	3.8%	271	0.0%
2014	746	4.0%	282	0.0%
2015	765	2.1%	306	0.3%
2016	791	3.5%	402	0.0%
2017	820	3.9%	473	0.2%
2018	746	4.4%	420	0.5%
2019	642	3.7%	380	0.0%

Critical Care

The mean in-hospital crude mortality rate for inpatients with a diagnosis of sepsis admitted to critical care from 2011-2015 showed an average of 34% (Figure 7). For the period 2016-2019 this dropped to 31.4% representing a statistically significant improvement since the inception of the national clinical programme for sepsis.

Figure 7: Statistical process control chart of hospital mortality for adult inpatients with a diagnosis of sepsis and admitted to a critical care area, quarterly data, 2011 – 2019.



Summary of the changes in inpatients with sepsis admitted to critical care, 2011 – 2019.

% Change mortality 2011 – 2019	**↓ 22.68%**

In 2019, 27.5% of sepsis patients were admitted to a critical care bed and their mortality is almost twice that of those managed on the ward (Table 6).

Table 6: Admission and crude mortality rates for adult inpatients (non-maternity) admitted to a critical care area with a diagnosis of sepsis or septic shock, 2019

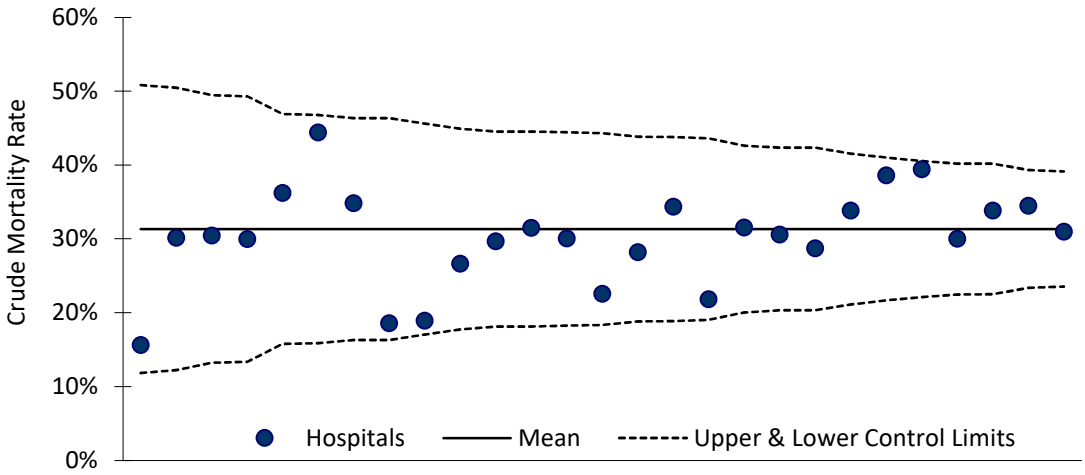
	Total Number of Cases	Number of cases admitted to critical care	Proportion of cases admitted to critical care	Crude Mortality Rate of cases admitted to critical care
Sepsis + Septic Shock	12,908	3550	27.5%	31.18%

The Centres for Disease Control and Prevention (CDC) report that 80% of all sepsis cases arise in the community and therefore present to the emergency department. The majority of these cases, 76.7%, are managed on a general ward and these patients have

alarming mortality rate of 14%. Capacity in critical care is the limiting factor for admission and increasing capacity and critical care admission of sepsis cases, not just for the most physiologically deranged, will give them the best opportunity to survive.

In the absence of age and co-morbidity adjustment, which would allow hospital sepsis-associated mortality be published, the funnel plot (Figure 8), depicts the age-adjusted hospital mortality in patients with a diagnosis of sepsis and who were admitted into a critical care area in hospitals who had more than 40 of such cases. It demonstrates no difference in mortality, other than that which can be accounted by statistical variation, amongst these units. It is the hope of the National Sepsis Programme to be able to produce such a plot for all acute hospitals that manage sepsis patients, into the future. This would assure the public that their hospital achieves similar outcome goals as others in the state and if a hospital has outlier status, it will enable intervention to correct that status and associated outcomes.

Figure 8: Inpatient crude mortality rate for adult inpatients with a diagnosis of sepsis and admitted to a Critical Care area, by hospital, 2019.



Sepsis, Infection and all other diagnoses (Mortality & Resource utilisation)

It is of interest to compare sepsis cases with those coded as infection and any other diagnosis as it demonstrates the clear difference in these disease processes in terms of average length of stay and outcome (Table 7). This is a clear driver to investigate the patient with infection for evidence of organ dysfunction, not just so they can be labelled correctly but also so they can get the urgent time-dependent therapy that is associated with improved outcome and so they can have early input from senior decision makers to drive that therapy forward in terms of source control, critical care management and other complex needs.

Table 7: Healthcare usage and mortality for adult inpatients (non-maternity) with a diagnosis of sepsis vs infection and all other diagnosis 2019

Diagnosis	Number of inpatients	Bed Days Used	AvLos	% of total inpatients	Number of deaths	% of total deaths	Crude mortality rate
Sepsis	**12,908**	**327,893**	**22.4**	**2.84%**	**2,543**	**24.0%**	**19.7%**
Medical	12,005	205,638	17.1				
Surgical	2,634	122,255	46.4				
Infection	**115,103**	**1,312,298**	**11.4**	**25.32%**	**4,491**	**42.4%**	**3.9%**
Medical	102,301	1,050,662	10.3				
Surgical	12,802	261,636	20.4				
All other diagnoses	**326,574**	**1,547,789**	**4.7**	**71.84%**	**3,557**	**32.3%**	**1.1%**
Medical	245,950	1,155,081	4.7				
Surgical	80,624	392,708	4.9				

In 2018, the average length of stay for surgical patients with sepsis is 46.4 days. The opportunity to shorten this by earlier recognition and treatment will not only improve patient outcome but also free up bed days for patients on waiting lists.
In 2019 the average length of stay for sepsis (including septic shock) was 22.9 days representing a 2% increase on 2018 (n=22.4 days).

Key findings:

Sepsis patients have a 5.2 fold higher mortality over patients coded with infection and a 2-fold higher length of stay

Summary of changes 2011 – 2019.

Change in the number of documented changes	**↑ 114%**
Change in AvLOS	**↑2%**

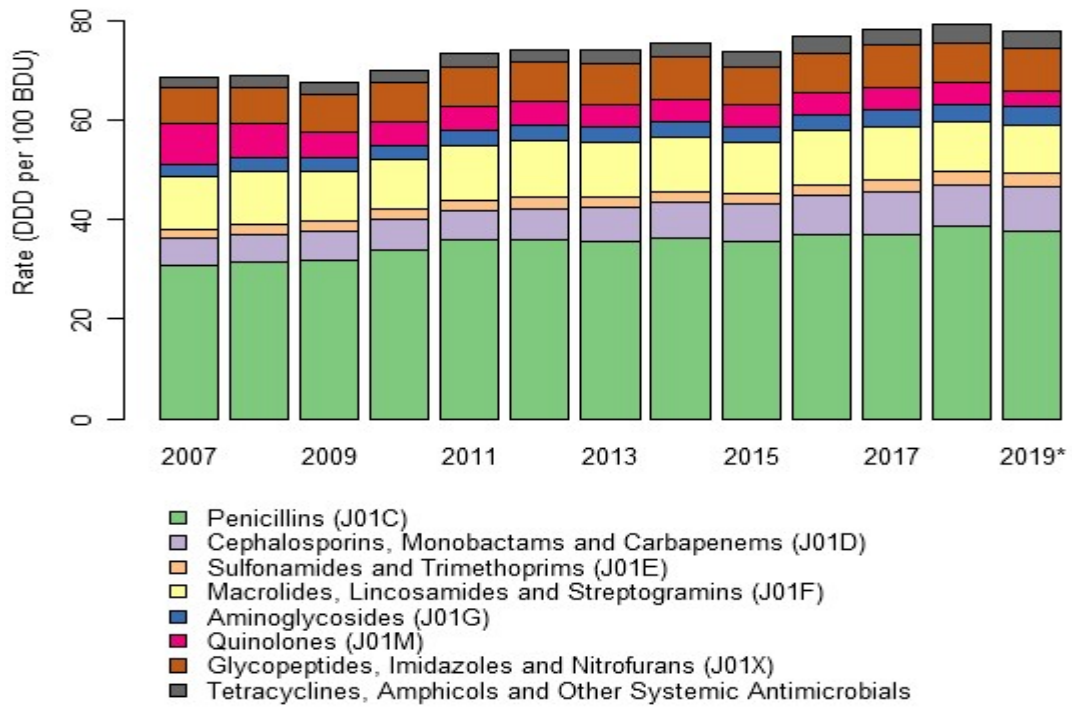
Balancing measures

Hospital antimicrobial consumption

The following data is from the Hospital Antimicrobial Consumption Surveillance report published by the Health Protection Surveillance Centre (HPSC). Further details are available at www.hpsc.ie

The median rate of antimicrobial consumption in 41 public acute hospitals in Ireland for 2019 was 78.1 defined daily doses per 100 bed days used (DDD/100BDU; range = 29.7 – 101.5), a slight decrease from 2018 (79.5 DDD/100BDU). This rate of antimicrobial consumption is mid-range in comparison with other European countries. Carbapenem consumption continued to decrease and stabilised, having peaked in 2014, as has consumption of fluoroquinolones. However, third-generation cephalosporin consumption increased. Use of penicillin in combination with a beta-lactamase inhibitor (such as co-amoxiclav) remained at high levels and increased in 2019.

Figure 9: Antimicrobial consumption by class, 2007-2019 (defined daily doses per 100 bed days used)



Multi-drug resistant organisms

***Escherichia coli*:** Multi-drug resistance remains a significant problem in this pathogen, which is the most frequent cause of urinary tract infection and a common pathogen in intra-abdominal infection. In 2019 of 3,439 patients with invasive *E. coli* infection (bloodstream and/or CSF) 11.9% were caused by extended-spectrum β-lactamase (ESBL)-producing *E. coli* and 6.0% were multi-drug resistant (MDR) *E. coli* (displaying resistance to three or more antimicrobial classes). There were no reported cases of carbapenemase-producing *E. coli* invasive infection in 2019.

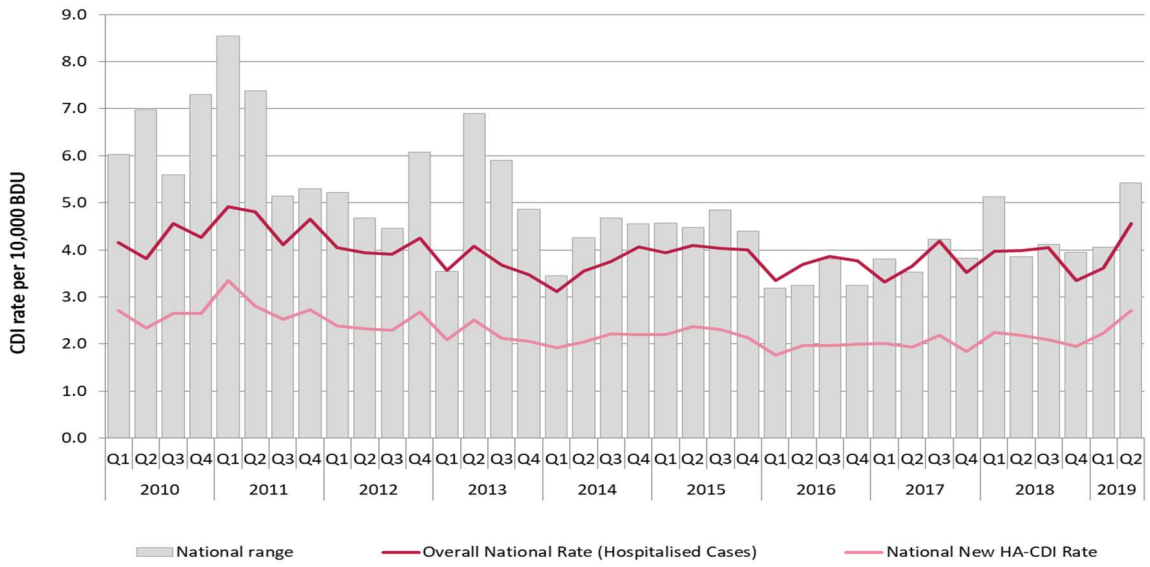
***Klebsiella pneumoniae*:** There was a decrease in the proportion of *K. pneumoniae* invasive infections that were MDR in 2019 to 5.9% versus 8.3% in 2018. There were six reported cases of carbapenemase-producing *K. pneumoniae* invasive infections in 2019.

***Staphylococcus aureus*:** While the number of *S. aureus* BSI in 2019 remained stable (n=1,186), there were reductions in both the proportion (12.1%) and rate (0.033 cases per 1,000 BDU) of *S. aureus* BSI that were meticillin resistant (i.e. MRSA).

***Enterococcus faecium*:** The proportion of *E. faecium* BSI that were vancomycin resistant (i.e., VRE) remained high at 38.6%, though reduced from 45.9% in 2015. Ireland still has one of the highest proportions in Europe of VRE causing BSI.

***Clostridioides difficile* infection (CDI): Data for 2019 is to end Q2 only.** There were 891 cases of CDI reported to enhanced surveillance in the first half of 2019. The incidence rate of new healthcare-associated (HCA) CDI, that originated within the participating hospital, was 2.5 per 10,000 bed days used (BDU), higher than that of 2018 (2.1).

Figure 10: Quarterly national CDI rates per 10,000 BDU. Overall (red) and new Hospital-acquired CDI (pink). * 2019 data to the end of Q2 only



Maternal Sepsis Summary

Lead ADON/M Dr. Karn Cliffe

"Maternal sepsis is a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion, or post-partum period (2016)". Due to the on-going COVID-19 pandemic process audits in maternity care settings have not been carried out in 2020.

In 2019, there were 59,796 (CSO, 2019) births in Ireland. There were 442 inpatient admissions with a diagnosis of sepsis (Hospital Inpatient Enquiry HIPE 2019).
Using the Maternity Sepsis Predisposition and Recognition Form remains the most effective way of supporting clinical decision making. Pregnant women due to physiological changes in pregnancy may not present with obvious systemic inflammatory signs or symptoms. Professional judgement cannot be underestimated. The National Sepsis Programme recommend that The Irish Maternity Early Warning System (IMEWS) and the Maternal Sepsis Predisposition and Recognition Form be used to assess all pregnant women and women up to 42 days post birth regardless of the care setting.

Paediatric Sepsis

Lead ADON Nuala Clarke

In 2020, the National Sepsis Programme continued working to improve the recognition and management of sepsis in children across the acute healthcare system. We also initiated a targeted public awareness campaign to provide members of the public, patients and their families with the tools to recognise the signs and symptoms of sepsis and enable them to ask the question 'could it be sepsis?'

There are four work strands to support this:

- Adopting the Surviving Sepsis Campaign (SSC) guidelines for Managing Septic Shock and Sepsis-Associated Organ Dysfunction in Children in 2020 and developing a National Implementation Plan (NIP) to support the implementation of the SSC recommendations in the Irish Healthcare system.
- Developing Paediatric Sepsis clinical decision support tools (Sepsis Forms and Algorithms): The National Sepsis Programme together with the National Clinical Programme for Paediatrics and the Paediatric Clinical Advisory Group (CAG) established a design group with paediatric medical and nursing expertise, to develop a clinical decision support tool to support early recognition and timely treatment of paediatric sepsis patients. Following an information/education workshop in the RCPI, attended by representatives from the 16 paediatric hospitals/units, the Paediatric Sepsis Form was piloted with feedback received from 9 of the 16 hospitals/units. A governance group was established by the Children's Hospital Group and the National Sepsis Programme. This group was tasked with reviewing the feedback received at stage 1, re-designing and re-piloting the Paediatric Sepsis Form. The re-pilot is currently in progress across sites.
- Development of educational material for National rollout to establish educational curricula consistent with the SSCGC recommendations, the NIP and the amended Sepsis form.
- Public awareness of paediatric Sepsis

  Posters and cards were developed as part of the suite of National Sepsis Awareness resources and were launched in September for International Sepsis Awareness month. World Sepsis awareness days were successfully held in all the acute hospitals caring for children nationally.

  Paediatric specific video & social media cuts were developed in 2020. These were disseminated in October 2020 through the HSE and CHI communication links to all hospital groups, CHOs, primary care, the GP Network & ICGP. Social cuts were tweeted from the National Sepsis Programme through these forums and were well received and retweeted significantly. See attached links to view same. Paediatric Sepsis Awareness video: https://vimeo.com/462650865/610bbcef55

  HSE - Paediatric Sepsis Awareness - Social Cut #1 Symptoms: https://vimeo.com/467302017/aa0a415dbe

Hospital Groups

In 2020, due to the re-deployment of Sepsis ADONs because of the Covid-19 pandemic, the National Sepsis Programme could not conduct process audit.

Sepsis remains a key patient safety issue both at hospital and Group level and robust structures have been put in place to support and monitor implementation of National Clinical Guideline No. 6 – Sepsis Management (NCG), including:

- Sepsis is a standing item on HCAI/AMR Group Oversight Committees which meet quarterly and are chaired by Hospital Group CEOs.
- All Groups have either made sepsis eLearning mandatory for all relevant HCWs or are planning to do so with the launch of the updated Sepsis eLearning programme.
- Group Sepsis ADON/Ms:
    - Provide support to local sepsis committees.
    - Undertake process audits to measure compliance at hospital level with the NCG and provide feedback on audit results to Local and HG Leadership.
    - Provide information and updates as relevant.

Despite the challenges presented by COVID-19, many hospitals held sepsis awareness events for World Sepsis Day - 13th September and throughout the month of September (Sepsis Awareness Month). These events included: sepsis simulations; information stands for staff, patients, and visitors; virtual and in person presentations; staff quizzes; poster displays and ward-based education. Many Irish hospitals are featured on the annual World Sepsis Day global event poster.

Sepsis associated crude mortality rates for 2019 per Hospital Group are presented in table 10.

Table 8: Hospital Group crude mortality rate for sepsis & septic shock, 2019. Adult inpatients only, excluding maternity and paediatrics

Hospital Group	2018	2019	Percentage increase(↑)/decrease(↓)
DMHG	21.3%	20.1%	5.6%↓
IEHG	19.5%	19.7%	1%↑
RCSI	20.1%	18.5%	8%↓
SAOLTA	20.1%	19%	5.5%↓
SSWHG	20.7%	21%	1.4%↑
ULHG	22.8%	18.6%	18.4%↓
National	20.4%	19.7%	3.4%↓

In addition, the Group ADONs have been working on national projects in 2020 including updating the National Clinical Guideline for Sepsis Management, the HSELanD Sepsis e-learning programme, the Adult and Paediatric Sepsis Forms and the Paediatric National Implementation Plan all of which will be launched in 2021.

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Appendix 1: The Sepsis Audit Subcommittee 2019

Member	Title
Martina Healy	National Sepsis Clinical Lead
Gráinne Cosgrove	Senior Statistician, Measurement for Improvement Team, QID
Ciara Hughes	Programme Manager National Sepsis Programme
Celine Conroy	Group Sepsis ADON Ireland East Hospital Group

Appendix 2: National Sepsis Steering Committee 2019/2020

Name	Job title and affiliation
Dr Fidelma Fitzpatrick	Consultant Microbiologist, Chair Sepsis Steering Committee
Dr Martina Healy	National Sepsis Clinical Lead
Ciara Hughes	National Sepsis Programme Manager
Prof. Garry Courtney	National Clinical Lead Acute Medicine
Dr Debbie McNamara	National Clinical Programme for Surgery
Jamie Logan	National Clinical Programme for Surgery
TBC	National Clinical Lead Obstetrics and Gynaecology
Dr. Karen Power	National Clinical Programme for Obs & Gynae
Dr. Michael Power	National Clinical Lead Critical Care
Dr. Omar Tujjar	National Clinical Lead Anaesthesia
Dr. Gerry McCarthy	National Clinical Lead Emergency Medicine
Fiona McDaid	Emergency Medicine Programme
Dr. Diarmuid O'Shea	National Clinical Programme for Older Persons
Siobhan Horkin	National Clinical Programme for Paediatrics and Neonates
Dr. Marie Keogan	National Clinical Lead – Pathology
TBC	Hospital Group CDONM representative
Dr. Cathal O'Broin	NCHD representative
Dr Vida Hamilton	NCAGL Acute Hospitals Division
Dr. Geraldine Shaw	ONMSD
Deirdre Murphy/ Jacqui Curley	Health Pricing Office
Declan McKeown	Health Intelligence Unit
Dr David O'Hanlon	Primary Care
Ms Avilene Casey	Deteriorating Patient Programme
Barbara Egan	Patient representative
Linda Dillon	Patient Advocacy Group
Mr Brian Power	Pre-Hospital Emergency Care Council
Ms Anne McCabe	NASCCRS (National Ambulance Service and critical care and retrieval services)
TBC	AMRIC representative
Gethin White	Library Services DSH
Tony McNamara	Hospital CEO/GM representative
Celine Conroy	Group Sepsis ADON - Ireland East Hospital Group
Dr Karn Cliffe	Group Sepsis ADON/M - Dublin Midlands
Fidelma Gallagher	Group Sepsis ADON - Saolta University Health Care Group to October 2020
Mary Bedding	Group Sepsis ADON - RCSI Hospitals
Yvonne Young	Group Sepsis ADON - UL Hospitals Group
Ronán O'Cathasaigh	Group Sepsis ADON - Saolta University Health Care Group
Kay O'Mahony	Group Sepsis ADON - South / Southwest to December 2019
Sinéad Horgan	Group Sepsis ADON - South / Southwest

Appendix 3: The National Sepsis Programme Team 2020

Member	Title
Martina Healy	National Sepsis Clinical Lead
Ciara Hughes	Programme Manager National Sepsis Programme (until October 2020)
Mary Bedding	Group Sepsis ADON RCSI Hospital Group
Karn Cliffe	Group Sepsis ADON/M Dublin Midlands Hospital Group
Celine Conroy	Group Sepsis ADON Ireland East Hospital Group
Sinéad Horgan	Group Sepsis ADON South/South West Hospital Group
Fidelma Gallagher	Group Sepsis ADON Saolta Hospital Group (until October 2020)
Yvonne Young	Group Sepsis ADON UL Hospitals Group
Nuala Clarke	Group Sepsis ADON Children's Health Ireland

Appendix 4: The Coding Process

The source document for coding in Ireland for HIPE is the medical record or chart. The clinical coder uses the entire chart to extract the conditions and procedures to provide a complete record of the patient and their health care encounter. The clinical coder, the person who translates medical terminology into alphanumeric code, performs an essential function in providing quality, accurate, and uniform medical information and greatly contributes to the continuous growth of medical knowledge. In addition to the discharge summary or letter, additional documentation referenced for coding a case include nursing notes, consultation reports, progress notes, operative reports, pre- and post-operative reports, pathology reports and more recently the sepsis screening form.

The classification used is ICD-10-AM/ACHI/ACS 8th Edition (International Classification of Diseases, 10th Revision, Australian Modification/ Australian Classification of Health Interventions/Australian Coding Standards). The Australian Coding Standards have to be adhered to by clinical coders in their work. These are complemented by the Irish Coding Standards(ICS). The ICS are developed to complement the Australian Coding Standards (ACS) and are revised regularly to reflect changing clinical practice.

ACS 0010 General Abstraction Guidelines states that coders cannot infer diagnoses from laboratory results and that "The listing of diagnoses on the front sheet and/or the discharge summary of the clinical record is the responsibility of the clinician". It further states, "Unless a clinician can indicate that a test result is significant and/or indicates the relationship between an unclear test result and a condition, such test results should not be coded".

All HIPE data are keyed in at the hospital using the HIPE Portal data entry system that runs an extensive number of validation edit checks to ensure the quality of the data. Other data quality activities and data quality tools are in use at local and national HPO level.

Appendix 4a: ICD-10-AM Diagnosis Codes for Sepsis

ICD-10-AM Diagnosis Codes	Description
A40	Streptococcal sepsis
A41	Other sepsis
A02.1	Salmonella sepsis
A22.7	Anthrax sepsis
A26.7	Erysipelothrix sepsis
A32.7	Listerial sepsis
A42.7	Actinomycotic sepsis
B37.7	Candidal sepsis
T81.42	Sepsis following a procedure
R65.0[1]	Systemic inflammatory response syndrome [SIRS] of infectious origin without acute organ failure
R65.1	Systemic inflammatory response syndrome [SIRS] of infectious origin with acute organ failure

1. ICD-10-AM 8th Edition code only, no corresponding 6th Edition Code. *This code is excluded from the new Sepsis-3 definition.*

ICD-10-AM Diagnosis Codes for Septic Shock

ICD-10-AM 8th Edition Codes	Description
R57.2[1]	Septic Shock

1. ICD-10-AM 8th Edition code only, no corresponding 6th Edition Code.

NOTE:

Data are based on inpatients grouped into three mutually exclusive categories:

(i) Inpatients with any diagnosis (principal or secondary) of septic shock

(ii) Inpatients with any diagnosis (principal or secondary) of sepsis, excluding cases with any diagnosis of septic shock as these are already captured in the septic shock category

(iii) Inpatients with any diagnosis (principal or secondary) of sepsis, excluding cases with any diagnosis of septic shock or severe sepsis as these are already captured in the septic shock or severe sepsis categories.

Appendix 4b: ICD-10-AM Diagnosis Codes for Infections

ICD-10-AM 8th Edition Codes	Description
A00 - B99[1]	Certain Infectious & Parasitic Diseases
G00 - G07	Meningitis, Encephalitis, Intracranial and intraspinal abscess and granuloma
J00 - J06	Acute upper respiratory infections
J09 - J18	Influenza and pneumonia
J20 - J22	Other acute lower respiratory infections
J36	Peritonsillar abscess
J44.0	Chronic obstructive pulmonary disease with acute lower respiratory infection
K35.0[2]	Acute appendicitis with generalised peritonitis
K35.2[3]	Acute appendicitis with generalised peritonitis
K35.3[3]	Acute appendicitis with localised peritonitis
K57.0, K57.2, K57.4, K57.8	Diverticular disease of intestine with perforation and abscess
K61	Abscess of anal and rectal regions
K65	Peritonitis
L00–L08	Infections of the skin and subcutaneous tissue
M00–M03	Infectious arthropathies
M86	Osteomyelitis
N10 - N12	Acute, chronic & not specified tubulo-interstitial nephritis
N13.6	Pyonephrosis
N39.0	Urinary tract infection, site not specified
N45	Orchitis and epididymitis
T802	Infections following infusion, transfusion and therapeutic injection
T81.41	Wound infection following a procedure
T82.6	Infection and inflammatory reaction due to cardiac valve prosthesis
T82.7	Infection and inflammatory reaction due to other cardiac and vascular devices, implants and grafts
T83.5	Infection and inflammatory reaction due to prosthetic device, implant and graft in urinary system
T83.6	Infection and inflammatory reaction due to prosthetic device, implant and graft in genital tract
T84.5	Infection and inflammatory reaction due to internal joint prosthesis
T84.6	Infection and inflammatory reaction due to internal fixation device [any site]
T84.7	Infection and inflammatory reaction due to other internal orthopaedic prosthetic devices, implants and grafts
T85.71	Infection and inflammatory reaction due to peritoneal dialysis catheter
T85.72	Infection and inflammatory reaction due to nervous system device, implant and graft
T85.78	Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts
T89.02	Open wound with infection

[1] Excluding diagnosis codes already included in the list of sepsis codes, i.e. A40, A41, A02.1, A22.7, A26.7, A32.7, A42.7, B37.7
[2] ICD-10-AM 6h Edition code.
[3] ICD-10-AM 8th Edition code.

Appendix 4c: Pregnancy related exclusions

Admission type = 6 (Maternity) or Any diagnosis (principal or additional) of O00 – O99 (Pregnancy, Childbirth and the Puerperium) or Any diagnosis of

- Z32 Pregnancy examination and test
- Z33 Pregnant state, incidental
- Z34 Supervision of normal pregnancy
- Z35 Supervision of high-risk pregnancy
- Z36 Antenatal screening
- Z37 Outcome of delivery
- Z39 Postpartum care and examination
- Z64.0 Problems related to unwanted pregnancy
- Z64.1 Problems related to multiparity