NATIONAL SEPSIS REPORT 2016

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Clinical Strategy and Programmes Division

5th September 2017

Dear Colleagues,

This is the second annual National Sepsis Outcome Report produced by the National Sepsis Programme produced by the National Sepsis Programme in collaboration with the Quality Improvement Division and thanks must be afforded to Ms. Grainne Cosgrove, Senior Statistician for the data herein and also with the Healthcare Pricing Office and the members of the Audit Subcommittee are listed in Appendix 1.

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.

In the first report covering 2011 – 2015 and available at www.hse.ie/sepsis, baseline data predating the implementation of the National Clinical Guideline No.6: Sepsis Management were published. This report describes the state of sepsis in 2016 and compares it with 2015 when the sepsis programme started its implementation programme.

The outcomes described herein are a credit to the Local Hospital Sepsis Committees, Sepsis ADONS, Sepsis Nurses, Programme Manager and the willingness of Clinicians to embrace the change needed to ensure that our patients are given the best opportunity to survive.

Kind regards,

Dr Vida Hamilton BE MB BAO MCh LRCP & SI FCARCSI FJFICMI
National Clinical Lead Sepsis

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Executive Summary

An analysis of sepsis incidence, and associated mortality and healthcare usage was extracted from the HIPE database using the codes outlined in appendix[4a].

2016:

In 2016, the definition of sepsis was changed from a clinical syndrome defined by a systemic inflammatory response (SIRS) due to infection to a life-threatening organ dysfunction caused by a dysregulated immune response to infection (formerly severe sepsis)[1,2]. This change is very welcome as identifies more clearly the cohort of patients who would most benefit from early treatment. However, it introduces some operational complications as it makes early recognition more difficult in some cases where blood tests are required to identify organ dysfunction.

The Irish database identifies 3 patient groups that have a mortality risk of > 20% if they are diagnosed with sepsis and the National Programme recommends that these patients receive the sepsis 6 bundle if they present to the Emergency Department (ED) or deteriorate on the ward with an infection.

These groups are:

1. Patients who are on chemotherapy or radiotherapy for cancer treatment.
2. Patients who present with clinically overt new onset organ dysfunction e.g. respiratory failure, shock, purpuric rash.
3. Patients who present with a SIRS response due to infection who have ≥ 1 co-morbidity associated with increased mortality from sepsis.
   (Age > 75 years, Cancer, Diabetes mellitus, COPD, Chronic kidney disease, chronic liver disease, HIV/AIDS, Frailty, Immunocompromised)

The Irish Sepsis-associated Crude Hospital Mortality Rate is 19%. Achieving a rate < 20% is in line with International Best Practice in high income countries. This rate does not include patients with SIRS of infectious origin without organ failure and thus represents a sepsis-3 compliant mortality rate and benchmarks Irish sepsis mortality rates favourably with other industrialised world countries with published mortality rates with German mortality rates at 24.3% in 2013[3] , the Australian at 18%[4] and documented mortality rate for sepsis at 17% and 26% for severe sepsis in high income countries[5].

There has been a 67% increase in the number of cases of sepsis documented in the cases notes between 2015 and 2016. Process audit of patient case notes shows a 60% documentation rate of sepsis in patients with infection and acute kidney injury in 2017 so there is still room for improvement and case mix remuneration is dependent on accurate documentation by clinicians in the case notes.

Sepsis affects 3.4% of hospital inpatients and contributes to 25% of in-hospital deaths and occupies over 300,000 bed days with and average length of stay (aLOS) of 20 days.

Key Findings

Number of cases	14,804
In- hospital mortality rate	18.5%
Sepsis-3 in-hospital mortality rate	19.0%
Critical care hospital mortality rate	31.3%
Paediatric sepsis- associated hospital mortality rate	3.5%
Maternal sepsis-associated hospital mortality rate	0%
Surgical DRG sepsis-associated hospital mortality rate	24.1%
Medical DRG sepsis-associated hospital mortality rate	17.4%

Key Comparators with 2015

- 67% increase in documented cases
- 19% decrease in hospital sepsis-associated mortality rate
- 17% decrease in average length of stay

Key Recommendations

1. The 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. The introduction of the new Sepsis-3 updated sepsis forms into all acute hospitals.
3. The introduction of the Maternal Sepsis Form to all maternity units pending the role out of the maternal electronic patient record, which incorporates the sepsis form.
4. Making the sepsis e-learning programme mandatory for hospital doctors and nurses.
5. Support seasonal and childhood vaccination programmes.
6. The appointment of healthcare professionals with dedicated time to support sepsis quality improvement (Q.I.) in the acute hospitals.
7. The ongoing guidance from Local Hospital Sepsis Committees for sepsis Q.I. implementation. Performance improvement programs are associated with a significant increase in compliance with care bundles and mortality, OR 0.66[2].

National Sepsis Report 2016

An Overview of the Burden Of Sepsis-Associated Mortality and Healthcare Usage, 2011 - 2015, as captured by the Hospital In-Patient Enquiry database (HIPE).

Introduction

National Clinical Guideline No. 6: Sepsis Management[1] was published in November 2014 and it outlines recommendations for the diagnosis and treatment of patients with sepsis with the aim of reducing morbidity and mortality from sepsis in Ireland.

In order to document the burden of sepsis, and its impact on mortality, the Hospital In-Patient Enquiry (HIPE) dataset was interrogated. Administrative data is widely used in quality improvement efforts (QI)[2,3] and has been validated in sepsis QI assessment.[6]

The National Sepsis Report will be published annually by the Sepsis Programme with the purpose of informing the acute sector of the burden of sepsis and its associated mortality rates. This will allow tracking of incidence and mortality rates that in turn will help guide healthcare resourcing and support ongoing efforts to give patients the best opportunity to survive.

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 2015 and the subsequent report is available at www.hpo.ie.

The National Sepsis Programme provides clinical decision support tools, the Sepsis forms (Appendix 5), that facilitate diagnosis and correct risk stratification and from which Coders can code, provided a medical professional signs 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

R65.0 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 (severe sepsis)

The inclusion of these new codes means the datasets analysed pre- and post-2015 are not identical and this needs to be taken into consideration when interpreting trends over the past 5 years.

Furthermore, in 2016, the latest definition of sepsis, Sepsis-3, excludes R65.0, SIRS of infectious origin without organ failure. For the purpose of trend analysis the same codes have been used as for the 2015 analysis. However, in order to be Sepsis-3 compliant R65.0 has been excluded from national sepsis-associated hospital mortality rate (19%) and for the purpose of international benchmarking.

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. Sepsis, identified by maternity specific codes (appendix 4c), were excluded as they are subject to analysis and reporting by Maternal Death Enquiry Ireland.[6]

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 but not mortality has also been identified. 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 is identified.

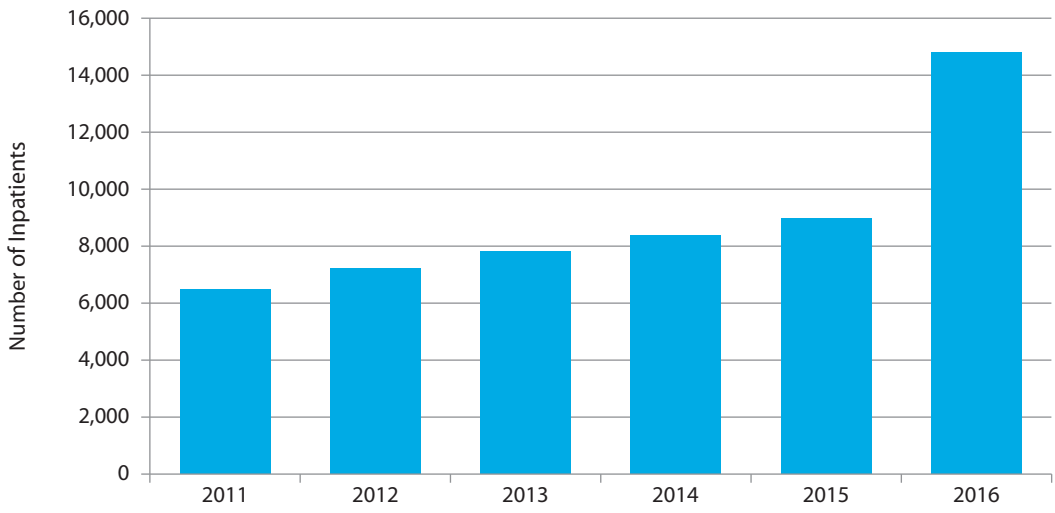
The data presented in this report are based on inpatients in publically funded acute hospitals with the diagnosis of sepsis coded on the HIPE system. Causality cannot be inferred as sepsis may be one of many diagnoses that complicated the patients' admission. Thus, mortality rates reported are sepsis-associated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

National Trends in Sepsis

As a consequence of the increased education about sepsis, the action of the local hospital sepsis committees and the willingness of clinicians to engage in this important initiative there has been an increase of 67% in the number of adult cases diagnosed as having SIRS of infectious origin and sepsis.

KEY FINDING: THE NUMBER OF CASES DOCUMENTED HAS INCREASED BY 67%

FIGURE 1: The trend in number of sepsis cases 2011 -2016



This report is based on adult cases of sepsis however, for completion, paediatric and maternity cases are included in a couple of the figures. Maternal morbidity and mortality is described in the confidential reports published bi-annually by MBRRACE UK (Mother and Baby reducing risk through audit and confidential enquiry) and MDE (Maternal Death Enquiry, National Perinatal Epidemiology Centre, Ireland).

The biggest impact on sepsis incidence and mortality is age; there is an increase in incidence at the extremes of age. The very young, especially < 1 year have an increase risk due to the immaturity of their immune system. As we get older we accumulate co-morbidities that increase risk and also develop progressive immunosenescence.

The Irish database on sepsis, obtained from the Hospital Inpatient Enquiry (HIPE) system, identifies that patients with age > 75 years and with one or more of the co-morbidities listed in table 1 have a mortality rate of > 20% if they contract sepsis. This information has been used to inform the Sepsis Forms (Appendix 5) and Algorithms so that these patients can be identified and treated with the Sepsis 6 bundle if they present unwell with infection. Empiric antimicrobial selection is based on the source and site of suspected infection taking into consideration any know colonization the patient may have and their allergy status.

Sepsis is diagnosed when acute organ dysfunction consequent to infection is diagnosed, this can be based on clinical presentation e.g. shock, respiratory or neurological impairment or by blood test analysis e.g. rise in serum creatinine, bilirubin or drop in platelet count.

The 3 patient groups identified as being at risk of mortality > 20% if they have sepsis, and who should receive the Sepsis 6 bundle, are:

1. Patients who present unwell with suspected infection who are Immunocompromised e.g. on chemotherapy or radiotherapy for cancer treatment.
2. Patients who present with clinically apparent acute organ dysfunction consequent to suspected infection.
3. Patients who present with suspected infection, a systemic inflammatory response and who have one or more of the co-morbidities associated with increased mortality in sepsis (Figure 2 and Table 1)

KEY FINDING: IN-HOSPITAL MORTALITY FOR INPATIENTS WITH A DIAGNOSIS OF SEPSIS BY AGE GROUPS, 2015

FIGURE 2: In-hospital mortality for inpatients with a diagnosis of sepsis by age groups, 2016

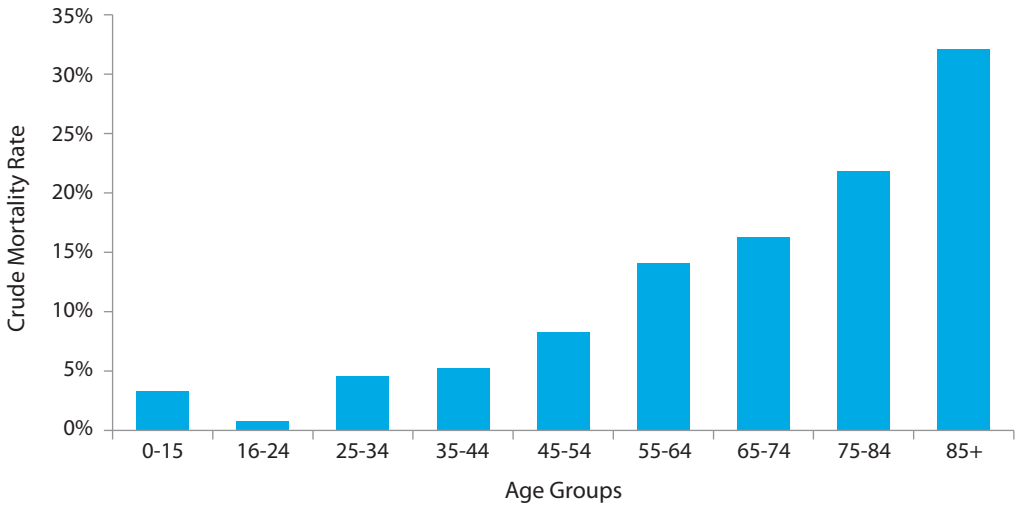
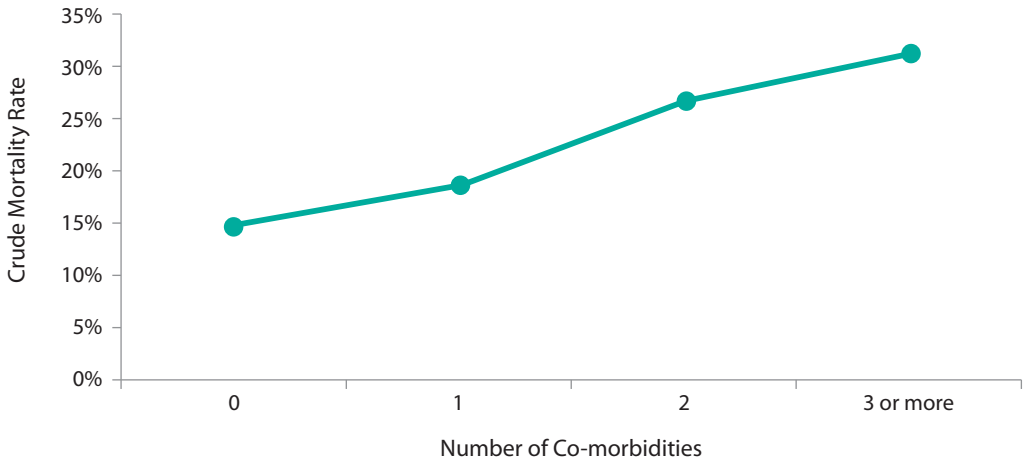


TABLE 1: Inpatients with a diagnosis of sepsis and selected co-morbidities; number of cases and crude mortality rates, 2016.

Co-morbidity	Number of cases	Crude Mortality Rate %
Mental & behavioural abnormalities due to alcohol	642	24.3%
COPD	2,102	21.7%
Cancer	3,245	20.8%
Chronic kidney disease	1,974	28.7%
Chronic liver disease	454	37.4%
Diabetes	3,081	20.4%
HIV Disease	45	11.1% (30.8%, 2015)
Age ≥ 75 years	6,467	25.8%

Note: Cases with more than one of the co-morbidities above are included in each of the relevant co-morbidity groups. As co-morbidities accumulate mortality rises.

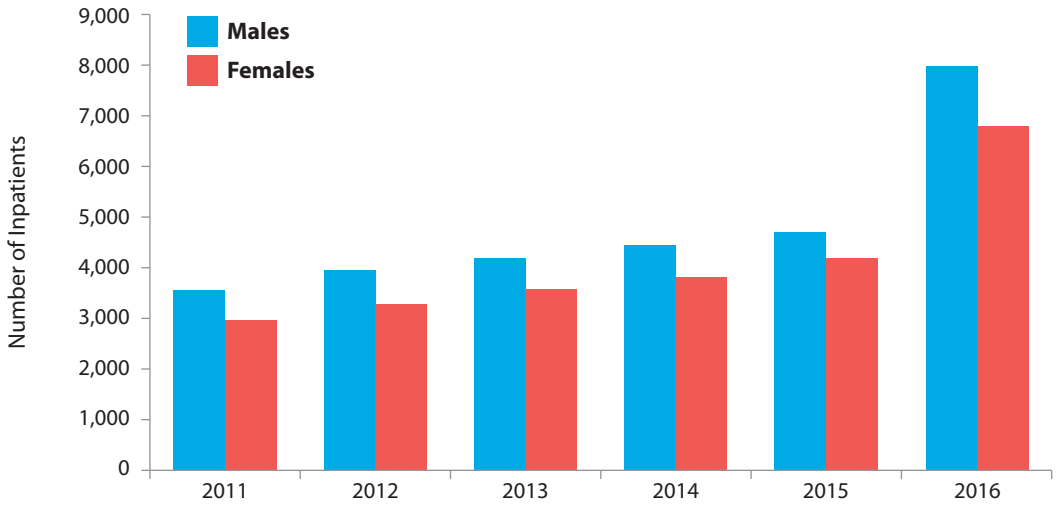
FIGURE 3: In-hospital mortality rate for inpatients with a diagnosis of sepsis and selected co-morbidities, 2016.



Gender Effects

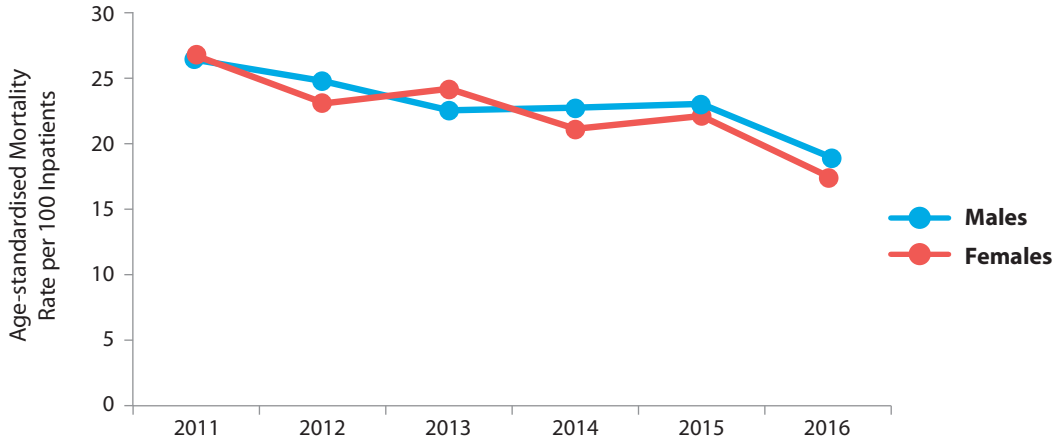
KEY FINDING: SEPSIS IS MORE COMMON IN MALES

FIGURE 4: Number of males and females with a diagnosis of sepsis, 2011-2016.



KEY FINDING: THERE IS NO DIFFERENCE IN AGE-ADJUSTED HOSPITAL MORTALITY RATES BETWEEN THE SEXES.

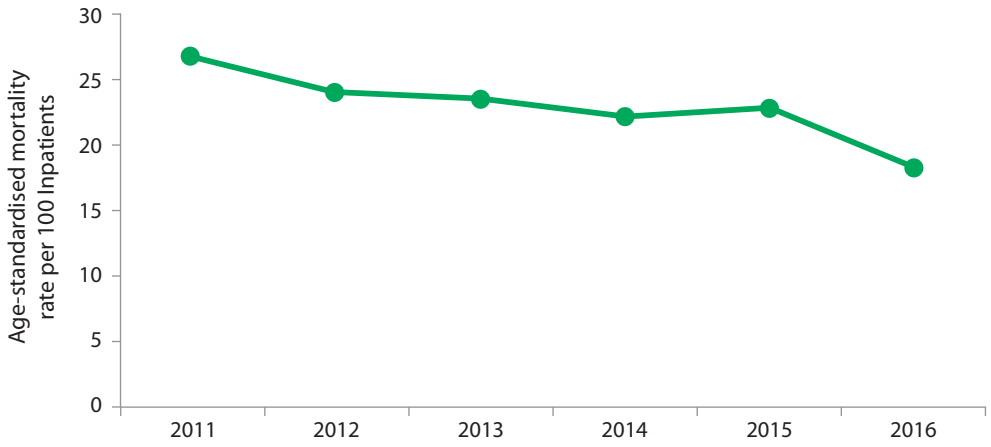
FIGURE 5: Age-standardised in-hospital mortality rates for males and females with a diagnosis of sepsis, 2011-2016.



Annual Mortality Trend for SIRS of Infectious Origin and Sepsis

KEY FINDING: THERE HAS BEEN A 31.5% DECREASE IN AGE-STANDARDISED MORTALITY IN INPATIENTS WITH A DIAGNOSIS OF SEPSIS OVER THE PAST 5 YEARS.

FIGURE 6: Age-standardised in-hospital mortality rate for inpatients with a diagnosis of SIRS of infectious origin and sepsis, 2011-2016.



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

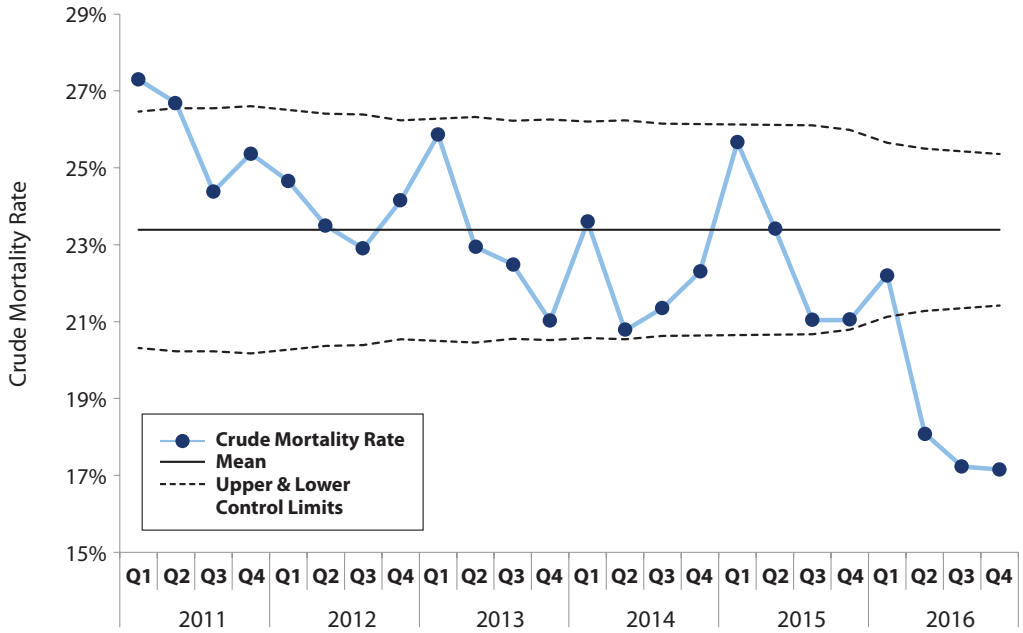
Mortality from sepsis and SIRS of infectious origin is steadily decreasing and has decreased by 17% since the National Clinical Guideline No.6: Sepsis Management was published in 2014 and by 31.5% over the past 5 years.

TABLE 2: Inpatients with a diagnosis of SIRS of infectious origin and sepsis, crude & age-standardised mortality rates, 2011 – 2016

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	22.1
2015	8,888	2,021	22.7	22.7
2016	14,804	2,735	18.5	18.3

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

FIGURE 7: In-hospital mortality for inpatients with a diagnosis of SIRS of infectious origin and sepsis, quarterly data, 2011 -2016



Quarterly analysis in a statistical process control P chart illustrates a number of occurrences of variation unlikely to have occurred by chance, thereby providing signals of improvement in the mortality rate.

PAEDIATRICS

Sepsis is not uncommon in paediatrics but has a much lower mortality rate, 3.5%, compared to adults. Paediatric patients with co-morbidities have increased risk and need to be identified and treated promptly. The Sepsis Programme is working with the Paediatric Clinical Advisory Group to develop and test a paediatric sepsis form to assist in this process. This form is now ready for pilot study.

MATERNITY

Sepsis occurs in approximately 1 in 214 pregnancies and puts both mother and foetus at risk. A Maternal Sepsis Form has been developed to identify patients at risk and to guide diagnosis, treatment and care escalation. (Appendix 5)

TABLE 3: Paediatric & Maternal Sepsis-associated incidence and crude mortality rates:

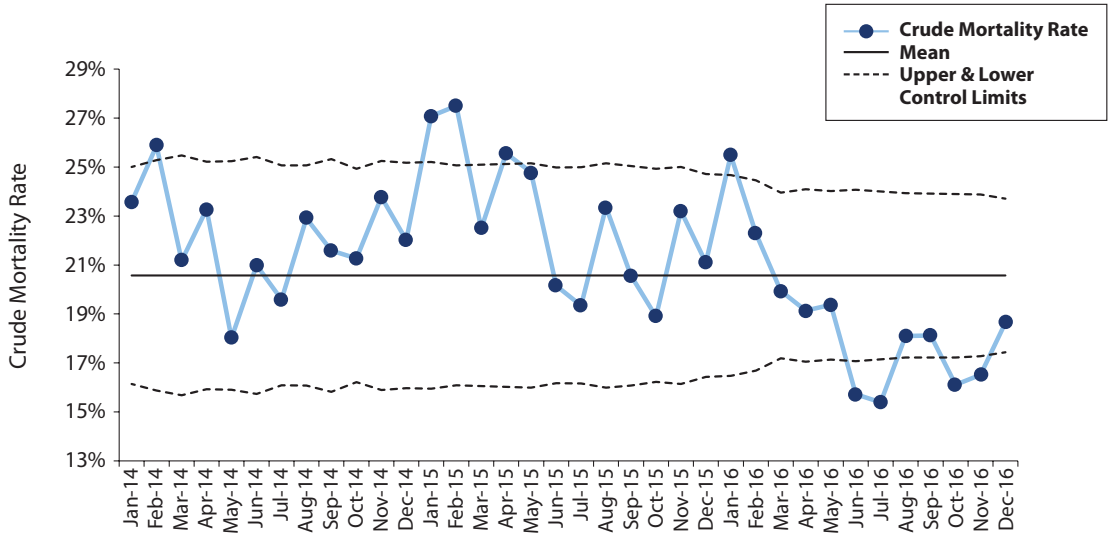
Year	Children aged 0-15 Years with a Diagnosis of Sepsis		Pregnancy Related Cases with a Diagnosis of Sepsis		All Other Adults aged 16+ with a Diagnosis of Sepsis		Total Cases	
	Number of Inpatients	Crude Mortality Rate	Number of Inpatients	Crude Mortality Rate	Number of Inpatients	Crude Mortality Rate	Number of Inpatients	Crude Mortality Rate
2011	737	3.0%	190	1.6%	6,495	26.0%	7,422	23.1%
2012	763	3.9%	192	0.5%	7,227	23.8%	8,182	21.4%
2013	763	3.8%	271	0.0%	7,797	23.1%	8,831	20.7%
2014	746	4.0%	282	0.0%	8,275	22.0%	9,303	19.9%
2015	766	2.1%	308	0.3%	8,888	22.7%	9,962	20.5%
2016	802	3.5%	416	0.0%	14,804	18.5%	16,022	17.2%

SEASONAL VARIATION

Monthly analysis shows an increased mortality rate during the months of January and February corresponding to peak influenza and other respiratory infections season. Many of these illnesses can be prevented, or the risk of contraction reduced, by vaccination. Given the clear identification of patients at increased risk of mortality, these patient groups should be informed and given the opportunity to receive vaccination in line with HSE policy.

KEY FINDING: THERE IS SEASONAL VARIATION IN SEPSIS-ASSOCIATED MORTALITY.

FIGURE 8: In-hospital crude mortality for inpatients with a diagnosis of SIRS of infectious origin, sepsis, severe sepsis & septic shock, monthly data, 2014 -2016.



PATIENTS ADMITTED TO A CRITICAL CARE AREA

Admission to a critical care area, CCU, HDU or ICU, is limited by capacity and in 2016, 24.6% of patients with a sepsis diagnosis were admitted to a critical care area. There has been a 15% decrease in the proportion of sepsis cases admitted to a critical care area in the past year that is reflected in the high acuity of critical care patients. Despite this there has been a modest decrease in mortality amongst these patients, 5% since 2014 and 17% since 2011.

FIGURE 9: Age-standardised in-hospital mortality rates for inpatients with a diagnosis of sepsis and admitted to a critical care area, 2011- 2016.

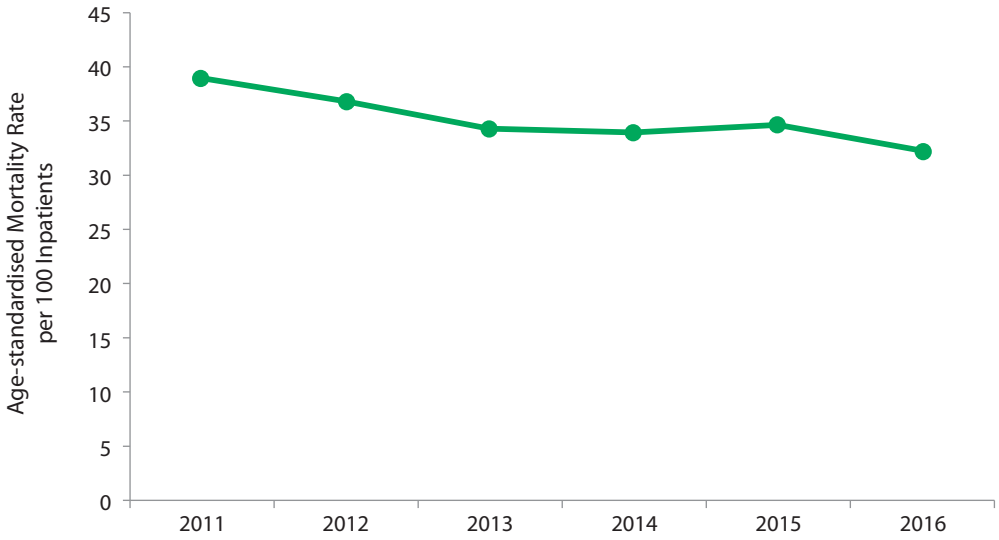
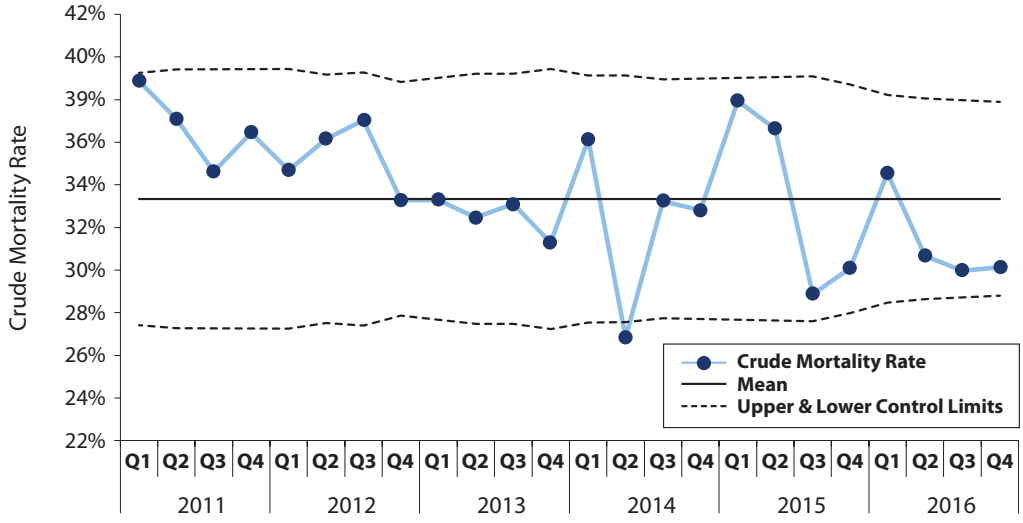


FIGURE 10: In-hospital mortality rate for inpatients with a diagnosis of sepsis and admitted to critical care area, by quarter, 2011 - 2016

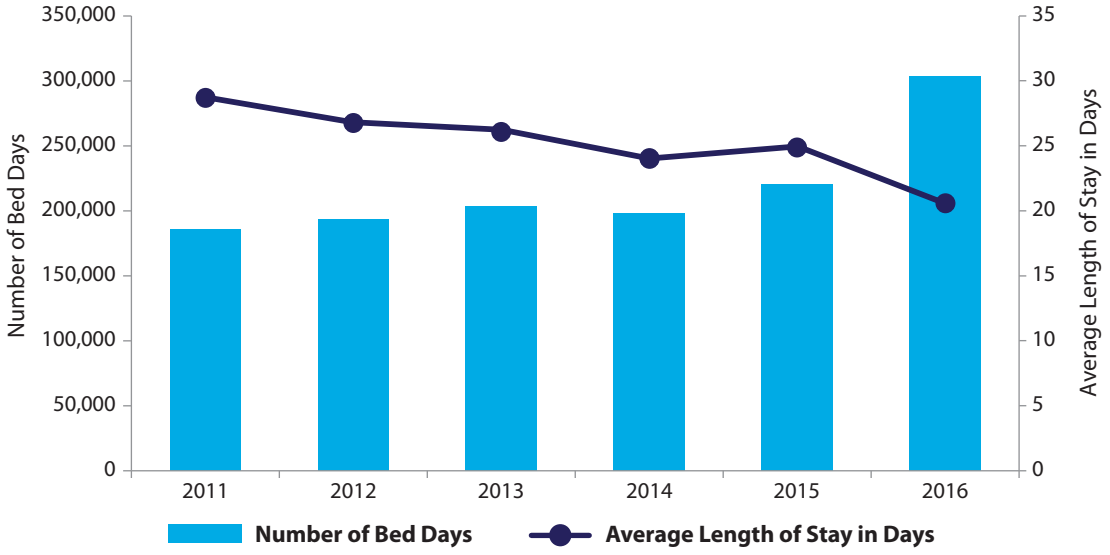


Quarterly analysis using a statistical process control chart shows unexpected variation in Q2 2014, where the mortality rate was below the lower control limit and in Q3 and Q4 2016 where the mortality rates were in the outer third of the control limits. These patterns are unlikely to have occurred by chance and therefore provide signals of improvement.

RESOURCE UTILISATION

Patients with SIRS of infectious origin and sepsis occupied 300,000 bed days in 2016; this amount was offset by the decrease in average length of stay by 14.5% since 2014 to 20.5 days.

FIGURE 11: Number of bed days and average length of stay for inpatients with a diagnosis of sepsis, 2011-2016.



Patients with an infection or sepsis diagnosis as part of their hospital diagnoses occupy 50% of all hospital beds. Rationalising their treatment with the aims of early diagnosis and prompt appropriate treatment not only maximizes survival opportunity but also is the single most important intervention to optimize bed utilization in the acute hospital sector.

FIGURE 12: Inpatients with a diagnosis of sepsis or infection: number of inpatients & bed days as a percentage of total inpatients & bed days.

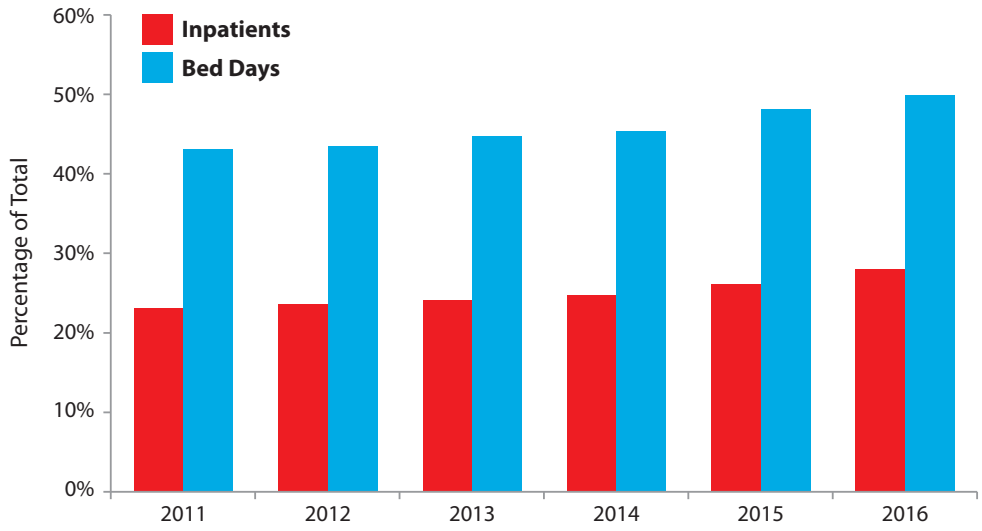


TABLE 4: Inpatients with a diagnosis of sepsis, by surgical / medical diagnosis related group, 2016.

Surgical / Medical DRG*	Number of Inpatients	Increase in in cases 2015-2016	% of total cases 2016	Crude Mortality Rate	Change in Mortality Rate 2015-2016
Surgical	2,429	30.8%	16.4%	24.1%	7.3% ⬇
Medical	12,375	76%	83.6%	17.4%	20.5% ⬇
Total	14,804	66.6%	100%	18.5%	18.8%* ⬇

* 19.4% reduction between 2015 and 2016 after adjusting for age differences.

Note: 'Surgical' refers to inpatients with a surgical Diagnosis Related Group (DRG) which is assigned if there is at least one significant surgical procedure carried out in an operating room during that episode of care. 'Medical' refers to inpatients with a medical DRG which is assigned if there are no significant surgical procedures during that episode of care. The 'Medical' group above also includes a small number of patients with a DRG classified as 'Other', that is they had a non-surgical operating room procedure.

Patients in a surgical diagnostic group who present with sepsis or develop sepsis in hospital have a higher mortality rate than those in a medical diagnostic related group. There has also been a significantly smaller reduction in mortality in these patients compared with those in the medical group since the National Guideline on sepsis management was rolled out in the acute sector. Further emphasis on sepsis recognition and management in the Acute Surgical Sector needs to be addressed.

Sepsis-associated crude hospital mortality, 2016

TABLE 5: Incidence of and crude mortality rates for SIRS of infectious origin, sepsis, severe sepsis and septic shock, 2016

	Number of cases	Crude hospital mortality Rate
SIRS of infectious origin	725	8.1%
Sepsis	12,516	16.8%
Severe sepsis	643	30.8%
Septic shock	920	41.4%
Total	14,804	18.5%

In 2016, the definition of sepsis was change by a task force set up by the Society for Critical Care Medicine (SCCM) and the European Society of Intensive Care Medicine (ESICM). The new definition (Sepsis-3) excludes SIRS of infectious origin without organ dysfunction (R65.0) from the suite of codes that describe patients with sepsis, it requires the presence of acute organ dysfunction consequent to an infection be present for a sepsis diagnosis to be made.

The crude sepsis-associated national hospital mortality rate for Ireland using this updated, Sepsis-3, definition is 19%.

TABLE 6: Admission and crude hospital mortality rates of inpatients admitted to a critical care area with a diagnosis of SIRS of infectious origin, sepsis, severe sepsis, or septic shock diagnosis.

	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
SIRS of Infectious Origin	725	78	10.8%	10.3%
Sepsis	12,516	2,577	20.6%	28.4%
Severe Sepsis	643	282	43.9%	38.3%
Septic Shock	920	698	75.9%	41.4%
Total	14,804	3,635	24.6%	31.3%

FIGURE 13: Number of inpatients with a diagnosis of SIRS of infectious origin, sepsis and septic shock by age groups, 2016.

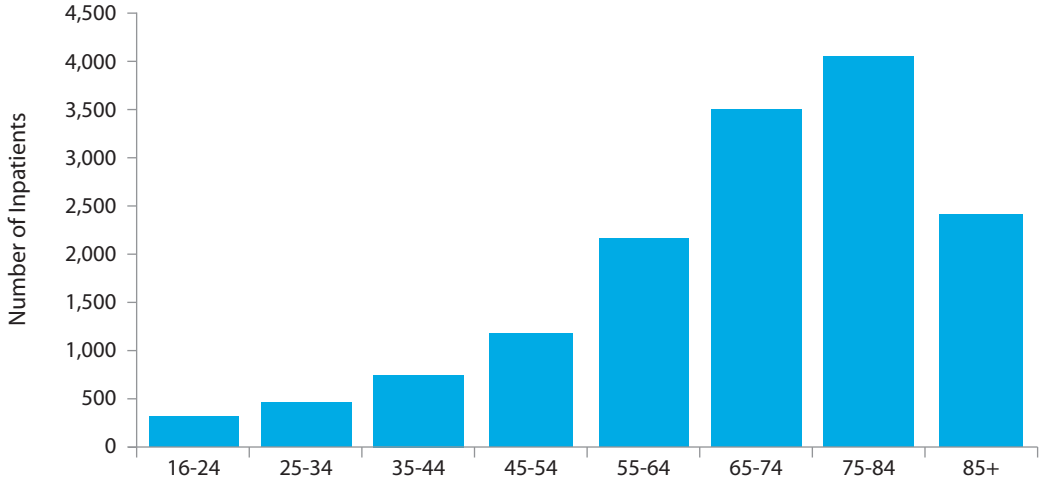
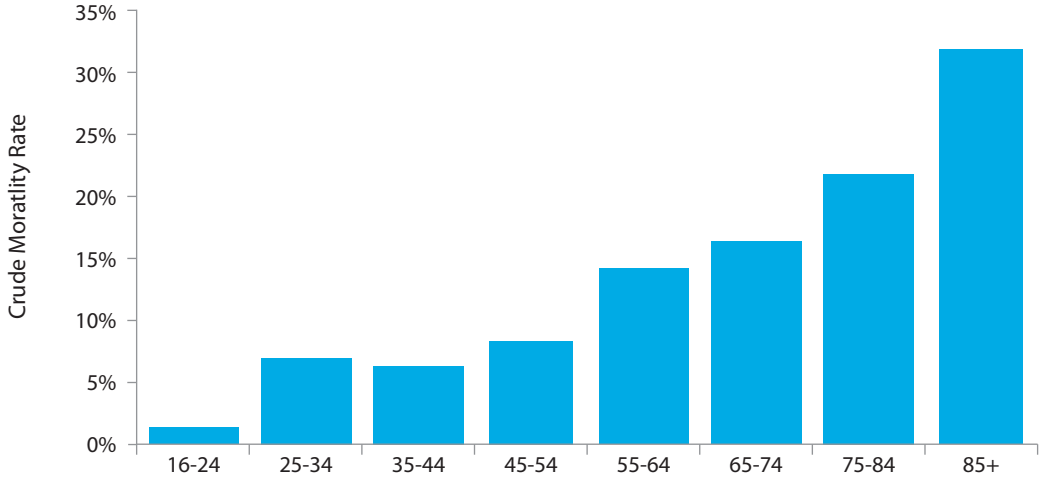


FIGURE 14: In-hospital mortality for inpatients with a diagnosis of SIRS of infectious origin, sepsis and septic shock by age groups, 2016.



Sepsis is not just a critical care diagnosis, 10,3OO patients were actively managed on the ward with a Sepsis-3 diagnosis without ever being admitted to a critical care area. Septic shock patients are not included in this number, as the reason for non-admittance to critical care cannot be concluded from this dataset. Potential reasons may include 'Not for escalation' orders or fulminant presentation.

FIGURE 15: Number of inpatients with a diagnosis of sepsis (excluding SIRS of infectious origin & septic shock) and without admission to a critical care area, 2016.

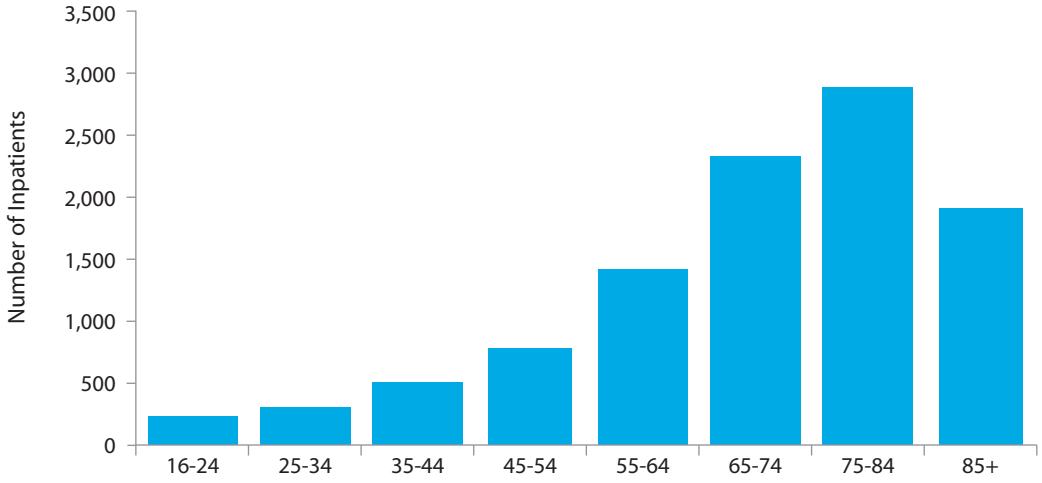


FIGURE 16: In-hospital crude mortality for inpatients with a diagnosis of sepsis (excluding SIRS of infectious origin & septic shock) and without admission to a critical care area, 2016.

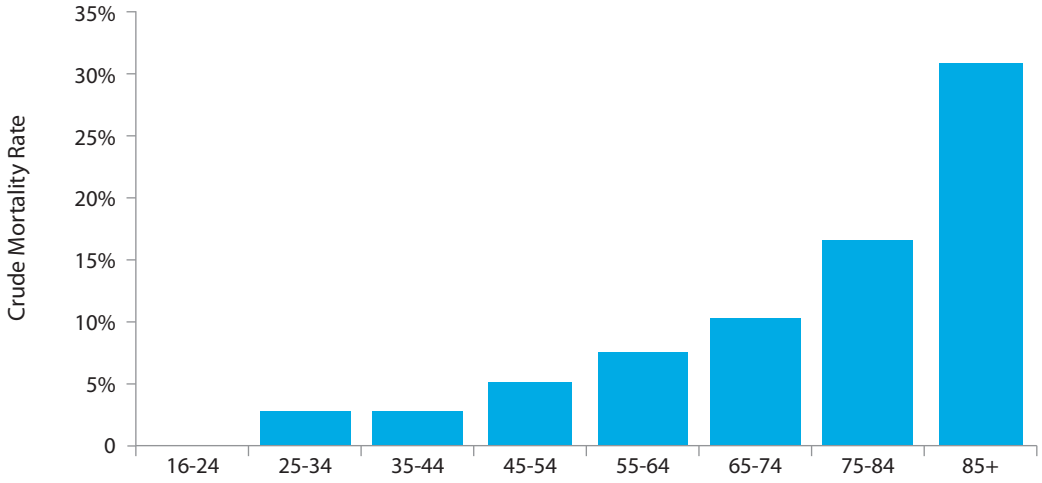


FIGURE 17: Number of patients with a diagnosis of SIRS of infectious origin, Sepsis, Severe Sepsis or Septic Shock admitted to a critical care area by age groups, 2016.

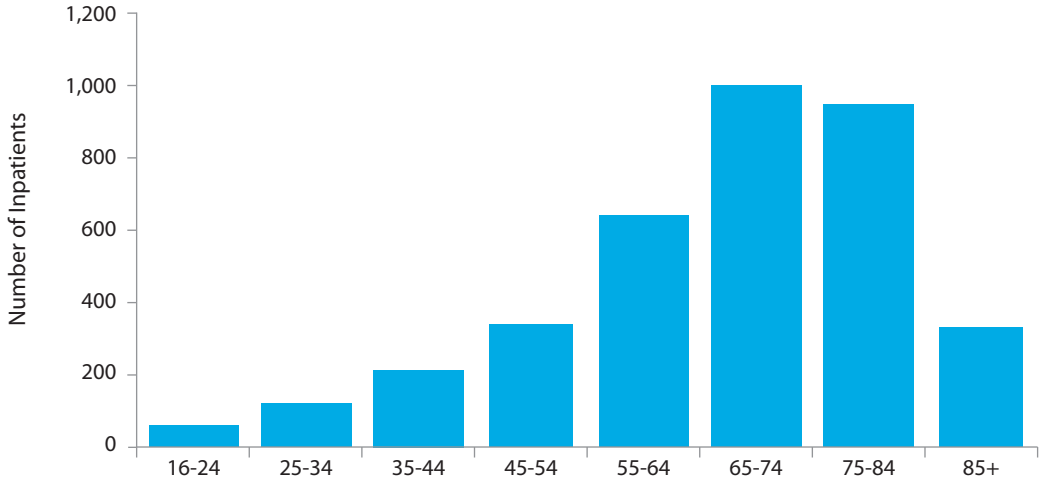


FIGURE 18: In-hospital mortality for inpatients with a diagnosis of SIRS of infectious origin, sepsis, severe sepsis or septic shock and admitted to a critical care area by age groups, 2016.

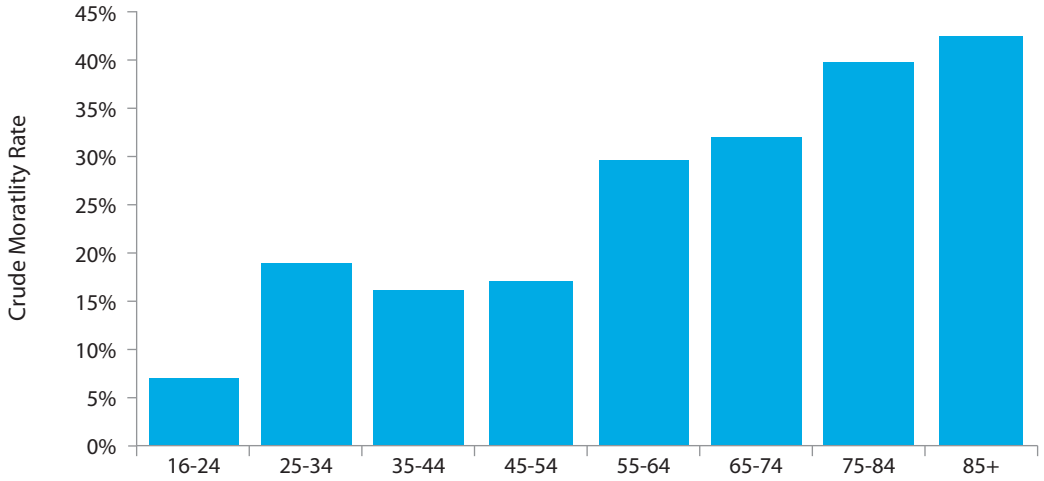
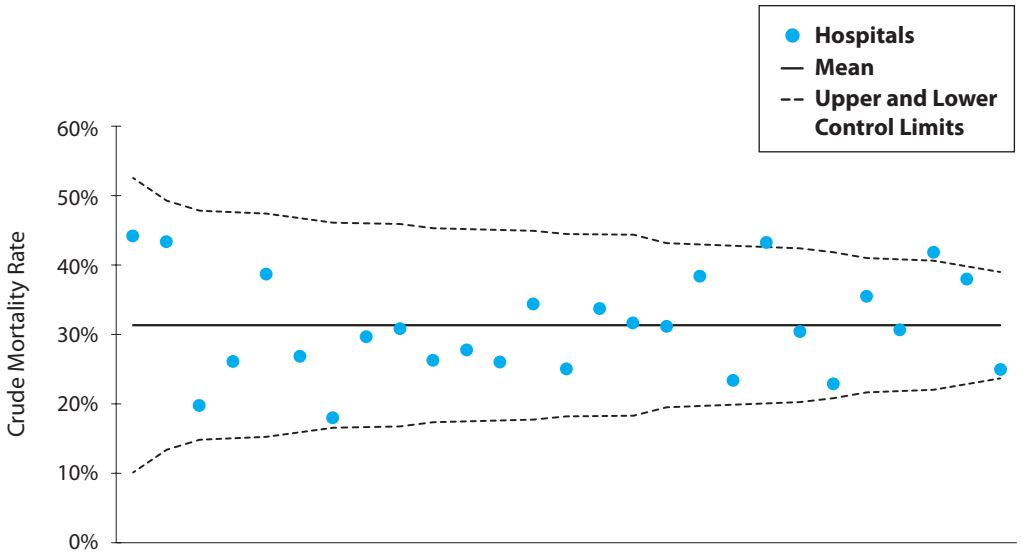


FIGURE 19: In-hospital Crude Mortality Rate for Inpatients with a Diagnosis of Sepsis and Admission to a Critical Care Area, by hospital, 2016



This funnel plot demonstrates the variation around the mean in crude hospital mortality of hospitals with > 40 cases admitted to a critical care area. Two hospitals fall outside the control limit. When age-adjusted one of these hospitals returns inside the control limit, the other will be asked to review its mortality rates taking into consideration their acuity and predicted mortality risk.

This funnel plot analysis has limited utility in inter-hospital benchmarking as it does not age and co-morbidity adjust the mortality rates. It can be expected that hospitals with an older age and higher co-morbidity profile will have higher mortality rates.

It is the intention of the National Sepsis Programme to develop a Sepsis Mortality Prediction Model and Scoring System that acute hospitals may be fairly benchmarked both nationally and internationally.

TABLE 7: Inpatients & deaths with a diagnosis of sepsis (including SIRS of infectious origin) or infection, 2016.

Diagnosis	Number of inpatients	% of total inpatients	Number of deaths	% of total deaths	Crude mortality rate
Sepsis	14,804	3.4%	2,735	24.8%	18.5%
Infection	108,314	24.6%	4,514	41.0%	4.2%
All other diagnoses	316,739	72.0%	3,774	34.2%	1.2%
Total	439,857	100%	11,023	100%	2.5%

KEY FINDING: SEPSIS OCCURS IN 3.4% OF HOSPITAL CASES BUT CONTRIBUTES TO 25% OF ALL HOSPITAL DEATHS.

Balancing measures:

The Health Protection Surveillance Centre (HPSC) publishes an annual surveillance report on its website www.hpsc.ie which includes

Key findings related to the Sepsis Programme include:

- Antimicrobial consumption rates
- MRSA rates
- ESBL producing E. coli rates
- MDR Klebsiella pneumonia rates
- New hospital acquired C. difficle infection rates

The 2016 report is pending.

National Process Audit 2017

489 patient case notes with a diagnosis of infection and acute kidney injury.

383 were identified as fulfilling the Sepsis-3 definition criteria and 227 (60%) were documented as sepsis in case notes.

37% had sepsis forms used and 62% of these were signed and therefore could be used for coding.

64% of patients received antimicrobials within the recommended time frame.

Lactates were taken in 75% of cases and 36% were ≥ 2 mmol/L. 71% of the cases with abnormal lactate had the level subsequently repeated.

42% of case notes showed evidence that a fluid bolus had been given.

40% of cases were admitted to a critical care area.

The 2017 process audit shows an ongoing under documentation of sepsis in the case notes. Sepsis form usage remains low. Hospitals with dedicated sepsis nurses show up to 300% increase in documentation, and with a difference of approximately €2000 between an infection and a sepsis diagnosis, this can be a cost neutral or profit making appointment.

Despite limited form use there is plenty of evidence of good practice but also room for improvement in treatment, delivery and therefore, survival opportunity.

Group Reports

South/Southwest Hospital Group

All hospitals continue to have active sepsis committees overseeing sepsis management within the hospitals. 2016 saw the introduction of the electronic chart, the Maternal and Newborn Clinical Management System, and to date it has been launched in two sites nationally both of which are in the SSWHG- Cork University Maternity Hospital and University Hospital Kerry. The electronic chart has a sepsis alert system, which prompts staff to action early medical review and treatment. This system will provide easy accessible reports for clinical audit.

The overall Hospital Group sepsis associated crude hospital mortality rate decreased by 21% from 2015 to 2016.

Within the SSWHG there are 4 dedicated Sepsis Nurses covering 5 hospitals that have positively impacted on the sepsis management and quality improvement within the Group. Collectively over Q1 & Q2 audits the sepsis form has been used in 51.6% of sepsis cases. 61.2% of sepsis patients received their antimicrobials within the 1-hour target and 96% receiving the correct antimicrobial as per local guidelines.

Of the combined sample of 91 cases in Q1 and Q2 audits 15.38% were correctly risk stratified and coded. There is a minimum potential loss of €2000/case when not correctly documented therefore this data reflects a loss of €154,000. Of the charts audited 71.4% were severe sepsis and septic shock therefore this figure is conservative.

Overall in 2016 there has been 128.18% increase in documented cases as coded by the HIPE department from 2015 data.

Dublin Midlands Hospital Group

There are seven hospitals in the Dublin Midlands Hospital Group. All have medical and nurse sepsis leads and have maintained sepsis committees that meet on a regular basis. In-patient crude mortality rates from 2015 to 2016 have decreased by 24.35%. During September 2016 three hospitals organised World Sepsis Day Events. Five hospitals are planning World Sepsis Day events through the month of September this year with the intention of raising awareness amongst staff and members of the public.

There was good uptake of the HSELanD National Sepsis eLearning programme with 370 (to June 2017) staff completing the online course successfully.

There are other significant improvements this year alone from audits carried out at the end of quarter 1 and quarter 2. Of note there was a 78.3% increase in sepsis forms used to aid recognition, diagnosis and appropriate treatment, with an overall 31.1% increase in diagnosis and documentation of sepsis. There was a 30.8% increase in the administration of antimicrobials in the first hour of diagnosis; 8.1% increase in the amount of lactates taken as part of the sepsis six bundle; 33.3% increase in evidence of administration appropriate fluid boluses.

It is worth noting that for every case of sepsis not correctly documented and therefore coded as sepsis the hospital is losing a minimum of €2,000 per inpatient episode.

National Maternity Form

The National Sepsis Programme together with a specially convened Maternity Working Group under the auspice of the National Clinical Programme for Obstetrics and Gynaecology developed a Maternity Sepsis Pathway. The pathway was piloted over two phases ensuring end user involvement in the final version. Following the development of the first pilot tool 12 of 19 maternity units piloted the form and gave feedback. Amendments were made based on the feedback and a further pilot was carried out in three maternity units. Further minor amendments were consequently made to the form that will be rolled out to all maternity units later this year. The maternity tool will be implemented following collaborative development of a robust education programme. The sepsis form will be audited following a period of use next year. This maternity sepsis form was used to inform Cerner. As Cerner is rolled out to all maternity units across the country this paper form will be phased out.

UL Hospital Group

Within the ULHG there are no dedicated Sepsis WTEs but there are identified nurse and medical sepsis leads in each of the 6 hospitals. ULHG has a group sepsis committee with multi-disciplinary members from each hospital. Recently NCHD and intern representatives have been invited to join the committee. There are twice yearly 8-hour sepsis study days for all staff and plans are under way to develop a maternity specific sepsis study day.

The sepsis form is available on the iHUB (hospital desktop portal), Q-pulse and in hard copy in each department and ward. The University Maternity hospital Limerick continue to use the Maternity sepsis form since it was piloted in June 2016 and there has been an increase of 433% in maternity sepsis cases coded by HIPE from 2015-2016. Sepsis has also recently been added to the E-discharge letter in UHL.

A sepsis form was used in 39% of sepsis cases audited in the Q1 & Q2 2017 audits. 83% of these patients received their antimicrobials within the recommended 1-hour target. Antimicrobials were administered as per local guidelines. 75% of patients had lactates taken and 83% had blood cultures taken pre-administration of antimicrobials. All patients with septic shock had a fluid bolus approach taken in their fluid resuscitation.

Correct documentation ensures that case mix accurate and the hospital is funded correctly.

The Emergency Department in UHL was the first ED to partake and complete a national pilot lead by the group sepsis ADON in ULHG and the Saolta group. In late March 2017 all Emergency Departments were invited to participate in a pilot. The National Sepsis Team asked each hospital to provide end user feedback for the updated clinical decision support tool. The forms included the new Sepsis 3 international consensus definitions and aimed to compare two versions of the tool for assessing organ dysfunction ie the SOFA score v's the organ dysfunction list. The aim was to produce an ED sepsis form that integrates current understanding of sepsis with a workable effective clinical decision support tool that can be updated as knowledge accrues. ED staff were asked to review the 2 sepsis forms in terms of **usability and efficacy**. 68% of staff from 11 emergency departments that feedback preferred the form that used the organ dysfunction list to assist diagnosis of sepsis.

In ULHG, from 2011-2016 there has been an 84% increase in documented sepsis cases coded by HIPE with the biggest increase of 43.9% being in 2016. The overall Group crude hospital mortality in 2016 was 20.27%.

Ireland East Hospital Group

The Ireland East Hospital Group has eleven hospitals all of which have sepsis committees in place that meet regularly to oversee implementation of *National Clinical Guideline No. 6-Sepsis Management*. The IEHG ADON for Sepsis also attends the local sepsis committee meetings to support local teams, provide information and updates as relevant. Each hospital has an identified medical and nurse sepsis lead to co-ordinate and monitor implementation in their hospital and report progress back through the sepsis committee. The sepsis leads also liaise with the IEHG ADON for Sepsis to arrange and help with planned compliance audits. World Sepsis Day Events were held by three hospitals in September 2016 to promote sepsis awareness amongst staff and members of the public. Eight hospitals are planning World Sepsis Day events this year.

In-patient crude hospital mortality rate from 2015 to 2016 has decreased by 15.35% and the number of patients with sepsis documented has increased by 32.3%.

There are some improvements and disimprovements this year alone as evidenced by compliance audits carried out in Q1 and Q2. Of note, there was:

- a 40% decrease in sepsis forms used to aid recognition, diagnosis and appropriate treatment, but an overall 48% increase in diagnosis and documentation of sepsis:
- a 27% increase in the administration of antimicrobials in the first hour of diagnosis;
- a 3% increase in the amount of lactates taken as part of the sepsis six bundle;
- a 10% increase in evidence of administration appropriate fluid boluses.
- In addition, most antimicrobials were prescribed as per local antimicrobial guidelines in both Q1 (84%) and Q2 (74%).

It is worth noting that for every case of sepsis not coded as sepsis the hospital could be losing a minimum of €2,000 per inpatient episode.

There was very good uptake of the HSELanD National Sepsis eLearning programme with 652 staff completing the online Elearning programme successfully (up to June 2017).

National Paediatric Sepsis Form

The National Sepsis Programme together with the National Clinical Programme for Paediatrics and the Paediatric Clinical Advisory Group (CAG) developed a clinical decision support tool, the *Paediatric Sepsis Form*, to support early recognition and timely treatment of paediatric sepsis patients. The final version is now completed and will be piloted once signed off by the CAG. Similar to the Maternity pilot, the paediatric pilot will take place in two phases ensuring end user involvement in the final version. All paediatric units will be invited to take part in the pilot and gave feedback. Amendments will be made based on the feedback.

Saolta University Health Care Group

The Saolta Group Early Warning Score & Sepsis Committee oversees the implementation of the National Clinical Guidelines on Sepsis Management and works closely with individual hospital Sepsis Committees. The Group has a nominated Clinical Lead for Sepsis.

Completion of the National Sepsis e-learning programme is mandatory for all Saolta Medical, Nursing & Midwifery staff and is underpinned by a Group Sepsis policy. 43% all Sepsis e-learning programmes completed nationally was by Saolta staff. The Sepsis ADON is working with individual HR and Medical Manpower Departments to improve compliance.

A multidisciplinary Sepsis Study Day was successfully video-linked to 6 centres for Nursing & Midwifery Education throughout the Group and had over 400 delegates over 3 days.

A Critical Care Conference addressing Sepsis Management will be held in Galway on November 22nd and is supported by the Saolta Group, National University of Ireland, Galway and the Western Anaesthesia Society. The Conference programme will include a number of renowned international, national and local speakers

The Irish premiere of Starfish, a movie based on the true-life story of sepsis survivor Tom Ray was in Galway on July 14th. This is a truly inspirational opportunity to increase sepsis awareness and as a result negotiations are on going to present the movie in other venues throughout the West of Ireland.

4 Saolta Hospitals participated in the recent pilot of the new ED Sepsis form that incorporated the new Sepsis 3 international consensus definitions.

Between 2015 -2016, the number of cases of Sepsis, Severe Sepsis and Septic Shock documented in the Group increased by 42%. The crude mortality rate for these cases during the same period fell by 31%.

2 National Compliance Audits were completed in all Saolta hospitals in Quarters 1&2 of 2017 and examined 118 patients (60 medical & 58 patients). 78 of the patients had sepsis and 12 had septic shock. 36 (31%) had the sepsis form completed and 13 patients (11%) had a completed signed sepsis form. 34 (29%) patients with sepsis were not documented as sepsis. Given that the difference in remuneration between infection & sepsis is approximately €2000, these findings of under-documentation represent a minimum loss of €68,000 to the Group. 39% of all cases audited received antimicrobials in less than 1 hour and 89% were prescribed antimicrobials according to local prescribing guidelines.

The Sepsis ADON has presented sepsis education sessions in all 7 Saolta Hospitals and attended local Sepsis Committee meetings when required, presenting national compliance report feedback, updates on the implementation of the new Sepsis 3 definitions and promoting local quality improvement projects. The National Sepsis Lead has presented at a number of Saolta hospital Grand Rounds.

The National Maternal Sepsis form that was piloted in a number of Maternity Units in 2017 remained in use in Saolta Maternity Units when the pilot was ended.

The Sepsis ADON has established links with NUI, Galway with regard to developing Galway as a sepsis research centre. There are a number of Saolta & NUIG staff members with interests related to sepsis that could be brought together into an energetic and broad research group

RCSI Hospitals Group

There has been much on-going work within the RCSI Hospital Group at local hospital level to improve the recognition and treatment of patients with sepsis. All hospitals continue to have functioning hospital sepsis committees that are actively engaged in improving sepsis care and there are medical and nursing leads in all hospitals. All hospitals have staff who have undertaken the HSE Sepsis eLearning programme and two hospitals, Connolly Hospital and Cavan Hospital undertake regular group sessions for sepsis eLearning.

Within the RCSI Hospitals the crude mortality rate for the hospital group decreased 22.5% from 2015 to 2016.

National compliance audits have continued in 2017 and these granular audits in Q1 & Q2 have provided very useful data on sepsis care. Whilst the sepsis forms was only used in 24% sepsis cases there was evidence of excellent practice with 82% of patients having a lactate taken and 76% patients having a repeat lactate taken if necessary and 64% patients received bolus' of IV fluids. However only 52% patients received their antimicrobials within the recommended 60 minutes and only 35% cases had the correct sepsis classification documented in their notes. For every sepsis case that is not correctly documented there is a potential loss of at least 2,000 per case, therefore under documentation within these two audits alone reflects a loss of remuneration for RCSI Hospitals.

The RCSI ADON has been involved in a national project to develop a sepsis form and pathway to be used in the community in residential care settings. Very soon the sepsis pathway will be tested in a pilot to be carried out in St Mary's Hospital, Phoenix Park.

Appendix 1: The Sepsis Audit Subcommittee

Member	Title
Vida Hamilton	National Sepsis Clinical Lead
Grainne Cosgrove	Senior Statistician, Quality Improvement Division
Christina Doyle	Programme Manager National Sepsis Lead
Deirdre Murphy	Head of HIPE & NPRS, HPO
Jacqui Curley	Coding Manager, Healthcare Pricing Office
Sinead Horgan	Group Sepsis ADON South/South West Hospital Group

Appendix 2: The Sepsis Steering Committee

Member	Title
Fidelma Fitzpatrick	Consultant Microbiologist, Chair Sepsis Steering Committee
Vida Hamilton	National Sepsis Clinical Lead
Kevin Rooney	National Clinical Lead on Sepsis Healthcare Improvement Scotland
Christina Doyle	Programme Manager National Sepsis Lead
Garry Courtney	National Clinical Lead Acute Medicine Programme
	Programme Manager Acute Medicine Programme
Michael Turner	National Clinical Lead Obstetrics and Gynaecology
Michael Power	National Clinical Lead Critical Care
Frank Keane	National Clinical Lead Surgery
Jeremy Smith	National Clinical Lead Anaesthesia
Robert Cunney	National Clinical Lead – HCAI and AMR prevention & QID representation
Marie Keogan	National Clinical Lead Pathology
Cathal O'Broin	NCHD representation
Karen Power	Project Manager Obs and Gynae
Deirdre Murphy	Head of HIPE & NPRS, HPO
Declan McKeown	Health Intelligence representation
Diarmuid O'Shea	National Clinical Lead Older Person Programme
Siobhan Horkin	Programme Manager Paeds and Neonatal Programme
Linda Dillon	Patient Advocacy Representative
David Hanlon	National Clinical Lead Primary Care Lead
Colm Henry	National Clinical Advisory and Group Lead – Acute Hospital
Tony McNamara	CEO/Hospital Manager Representative
Jean Kelly	Group Director of Nursing and IADNAM representative
Anne McCabe	National Transport Medicine representative
Gerry Mc Carthy	National Clinical Lead Emergency Medicine
Fiona Mc Daid	Emergency Nursing Representative
Rachel Gilmore	Emergency Medicine Representative
Geraldine Shaw	Office of the Nursing & Midwifery Services Director representative
Gethin White	Library Services DSH representative
Mary Bedding	Group Sepsis ADON RCSI Hospital Group
Karn Cliffe	Group Sepsis ADON Dublin Midlands Hospital Group
Celine Conroy	Group Sepsis ADON Ireland East Hospital Group
Sinead Horgan	Group Sepsis ADON South/South West Hospital Group
Ronan O Cathasaigh	Group Sepsis ADON Saolta Hospital Group
Yvonne Young	Group Sepsis ADON University Hospital Group

Appendix 3: The National Sepsis Programme team

Member	Title
Vida Hamilton	National Sepsis Clinical Lead
Christina Doyle	Programme Manager National Sepsis Lead
Mary Bedding	Sepsis ADON RCSI Hospital Group
Karn Cliffe	Sepsis ADON Dublin Midlands Hospital Group
Celine Conroy	Sepsis ADON Ireland East Hospital Group
Sinead Horgan	Group ADON South/South West Hospital Group
Ronan O'Cathasaigh	Group ADON Saolta Hospital Group
Yvonne Young	Group ADON University Limerick Hospital Group

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

[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 Severe Sepsis

ICD-10-AM 8th Edition Codes	Description
R65.1[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.

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 severe 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

Appendix 4d: Codes for selected co-morbidities

ICD-10-AM Diagnosis Codes for Cancer

ICD-10-AM 8th Edition Codes	Description
C00-C96	Malignant Neoplasms

ICD-10-AM Diagnosis Codes for Chronic Liver Disease

ICD-10-AM 8th Edition Codes	Description
K70.0	Alcoholic fatty liver
K70.2	Alcoholic fibrosis and sclerosis of liver
K70.3	Alcoholic cirrhosis of liver
K70.4	Alcoholic hepatic failure
K70.9	Alcoholic liver disease, unspecified
K71.3	Toxic liver disease with chronic persistent hepatitis
K71.4	Toxic liver disease with chronic lobular hepatitis
K71.5	Toxic liver disease with chronic active hepatitis
K71.7	Toxic liver disease with fibrosis and cirrhosis of liver
K72.1	Chronic hepatic failure
K72.9	Hepatic failure, unspecified
K73.0	Chronic persistent hepatitis, not elsewhere classified
K73.1	Chronic lobular hepatitis, not elsewhere classified
K73.2	Chronic active hepatitis, not elsewhere classified
K73.8	Other chronic hepatitis, not elsewhere classified
K73.9	Chronic hepatitis, unspecified
K74.0	Hepatic fibrosis
K74.1	Hepatic sclerosis
K74.2	Hepatic fibrosis with hepatic sclerosis
K74.3	Primary biliary cirrhosis
K74.4	Secondary biliary cirrhosis
K74.5	Biliary cirrhosis, unspecified
K74.6	Other and unspecified cirrhosis of liver
K76.0	Fatty (change of) liver, not elsewhere classified
K76.9	Liver disease, unspecified

ICD-10-AM Diagnosis Codes for Diabetes

ICD-10-AM 8th Edition Codes	Description
E10	Type 1 diabetes mellitus
E11	Type 2 diabetes mellitus
E13	Other specified diabetes mellitus
E14	Unspecified diabetes mellitus

ICD-10-AM Diagnosis Codes for Chronic Kidney Disease

ICD-10-AM 8th Edition Codes	Description
N18	Chronic kidney disease

ICD-10-AM Diagnosis Codes for COPD

ICD-10-AM 8th Edition Codes	Description
J41	Simple and mucopurulent chronic bronchitis
J42	Unspecified chronic bronchitis
J43	Emphysema
J44	Other chronic obstructive pulmonary disease
J47	Bronchiectasis

ICD-10-AM Diagnosis Codes for HIV

ICD-10-AM 8th Edition Codes	Description
B20	Human immunodeficiency virus [HIV] disease resulting in infectious and parasitic diseases
B21	Human immunodeficiency virus [HIV] disease resulting in malignant neoplasms
B22	Human immunodeficiency virus [HIV] disease resulting in other specified diseases
B23	Human immunodeficiency virus [HIV] disease resulting in other conditions
B24	Unspecified human immunodeficiency virus [HIV] disease

ICD-10-AM Diagnosis Codes for Mental and Behavioral Disorders due to use of Alcohol

ICD-10-AM 8th Edition Codes	Description
F10.1	Mental and behavioural disorders due to use of alcohol, harmful use
F10.2	Mental and behavioural disorders due to use of alcohol, dependence syndrome
F10.3	Mental and behavioural disorders due to use of alcohol, withdrawal state
F10.4	Mental and behavioural disorders due to use of alcohol, withdrawal state with delirium
F10.5	Mental and behavioural disorders due to use of alcohol, psychotic disorder
F10.6	Mental and behavioural disorders due to use of alcohol, amnesic syndrome
F10.7	Mental and behavioural disorders due to use of alcohol, residual and late-onset psychotic disorder
F10.8	Mental and behavioural disorders due to use of alcohol, other mental and behavioural disorders
F10.9	Mental and behavioural disorders due to use of alcohol, unspecified mental and behavioural disorder
Z86.41	Personal history of alcohol use disorder

Appendix 5: Sepsis Forms

SEPSIS FORM
MATERNITY PATIENTS

SEPSIS FORM
EMERGENCY DEPARTMENT ADULT

SEPSIS FORM
INPATIENT ADULT

Sepsis Predisposition & Recognition

(ALWAYS USE CLINICAL JUDGEMENT)

There is separate sepsis criteria for non-pregnant adult patients

RECOGNISE SEPSIS · ENHANCE SURVIVAL

MATERNITY PATIENTS

Complete this form and apply if there is a clinical suspicion of infection.

I

Section 1:

Midwife Name:

Midwife Signature:

NMBI PIN:

IMEWS:

Date: Time:

Patient label here

Maternal Sepsis is a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, child-birth, post-abortion or post-partum period (WHO 2016).

S

Section 2: Are you concerned that the woman could have infection

- ☐ History of fevers or rigors
- ☐ Cough/sputum/breathlessness
- ☐ Flu like symptoms
- ☐ Unexplained abdominal pain/distension
- ☐ Pelvic pain
- ☐ Vomiting and/or diarrhoea
- ☐ Line associated infection/redness/swelling/pain
- ☐ Possible intrauterine infection
- ☐ Myalgia/back pain/general malaise/headache
- ☐ New onset of confusion
- ☐ Cellulitis/wound infection/perineal infection
- ☐ Possible breast infection
- ☐ Multiple presentation with non-specific malaise
- ☐ Others

B

Section 3: Obstetric History

Para:

Gestation:

Pregnancy related complaints:

Days post-natal:

Delivery:

- ☐ Spontaneous vaginal delivery (SVD)
- ☐ Vacuum assisted delivery
- ☐ Forceps assisted delivery
- ☐ Cesarean section

Risk factors

Pregnancy Related

- ☐ Cerclage
- ☐ Pre-term/prolonged rupture of membranes
- ☐ Retained products
- ☐ History pelvic infection
- ☐ Group A strep in close contact
- ☐ Recent amniocentesis

Non Pregnancy Related

- ☐ Age > 35 years
- ☐ Minority ethnic group
- ☐ Vulnerable socio-economic background
- ☐ Obesity
- ☐ Diabetes, including non-gestational diabetes
- ☐ Recent surgery
- ☐ Immunocompromised e.g. Systemic Lupus
- ☐ Chronic renal failure
- ☐ Chronic liver failure
- ☐ Chronic heart failure

Record observations on the Irish Maternity Early Warning (IMEWS) chart.

Request immediate medical review

if you are concerned the woman has INFECTION plus ANY 1 of the following:

A

Section 4:

1. ☐ IMEWS trigger for immediate review, i.e. **>2 YELLOWS** or **≥2 PINKS**
2. ☐ SIRS Response, i.e. ≥2 modified SIRS criteria listed below.

   Modified SIRS criteria: Note - physiological changes must be sustained ≥30mins

   - ☐ Respiratory rate ≥ 20 breaths/min
   - ☐ Heart rate ≥ 100bpm
   - ☐ Fetal heart rate >160bpm
   - ☐ WCC < 4 or > 16.9 x 10^9/L
   - ☐ Temperature <36^0 or >38^{0}C
   - ☐ Acutely altered mental status
   - ☐ Bedside glucose >7.7mmol/L *(in the absence of diabetes mellitus)*
3. ☐ At risk of neutropenia, e.g. on anti-cancer treatment.

R

Section 5:

If sepsis suspected follow screening and escalate to Medical review. Use ISBAR as outlined.

Doctor's Name: **Time Doctor Contacted:**

Midwife's Signature:

Sepsis Form - Maternity

(ALWAYS USE CLINICAL JUDGEMENT)

There is separate sepsis criteria for non-pregnant adult patients

If infection suspected following History and Examination, Doctor to complete and sign sepsis screening form

Section 6: Clinical Suspicion of Infection

Document site:

- ☐ Genital Tract
- ☐ Urinary Tract
- ☐ Skin
- ☐ Respiratory Tract
- ☐ Intra-abdominal
- ☐ Catheter/Device Related
- ☐ Central Nervous System
- ☐ Intra-articular/Bone
- ☐ Unknown
- ☐ Other suspected site:

☐ **No clinical suspicion of INFECTION**: proceed to section 5.

Doctor's Initials

Section 7: Who needs to get the "Sepsis 6":

1. ☐ Infection plus: circle either **a** or **b** as appropriate.
   - **a.** SIRS Response, i.e. ≥2 modified SIRS criteria listed on page 1. Note - physiological changes must be sustained ≥30mins.
   - **b.** Clinically or biochemically apparent new onset organ dysfunction due to infection.
2. ☐ Patients who present unwell who are on treatment that puts them at risk of neutropenia, e.g. on anti-cancer treatment.

Doctor's Initials

☐ **YES. Start Maternal Sepsis 6 + 1** Time Zero: **Doctor's Initials**

Section 8

TAKE 3 — **SEPSIS 6 + 1* – complete *within 1 hour*** — **GIVE 3**

- ☐ **BLOOD CULTURES:** Take blood cultures before giving antimicrobials (if no significant delay i.e. >45 minutes) and other cultures as per examination.
- ☐ **BLOODS:** Check point of care lactate & full blood count, U&E +/- LFTs +/- Coag. Other tests and investigations as per history and examination. Other test and investigations and source control as indicated by history and examination.
- ☐ **URINE OUTPUT:** Assess urine output and consider urinary catheterisation for hourly measurement in sepsis/septic shock.

*** +1 If Pregnant, Assess Fetal Wellbeing** ☐

Laboratory tests should be requested as EMERGENCY aiming to have results available and *reviewed within 1 hour*

- ☐ **OXYGEN:** Titrate O_2 to saturations of 94 -98% or 88-92% in chronic lung disease. **N/A** ☐
- ☐ **FLUIDS:** Start IV fluid resuscitation if evidence of hypovolaemia. 500ml bolus of isotonic crystalloid over 15mins & give up to 2 litres, reassessing for signs of hypovolaemia, normovolaemia, or fluid overload. Caution in pre-eclampsia. **N/A** ☐
- ☐ **ANTIMICROBIALS:** Give IV antimicrobials according to the site of infection and following local antimicrobial guidelines.

Type: Dose: Time given:

Type: Dose: Time given:

Type: Dose: Time given:

Doctor's Initials

Section 9

☐ **NO**

Following history and examination, and in the absence of clinical criteria or signs. Sepsis 6 is not commenced. If infection is diagnosed, proceed with usual treatment pathway for that infection.

Doctor's Name: Date: Time:

Section 10: Look for signs of new organ dysfunction - any one is sufficient:

- ☐ Lactate > 2 mmol/L (following adequate initial fluid resuscitation, typically 30mls/kg in the first hour unless fluid intolerant)
- ☐ Cardiovascular - Systolic BP < 90 or Mean Arterial Pressure (MAP) < 65 or Systolic BP more than 40 below patient's normal
- ☐ Respiratory - New need for oxygen to achieve saturation > 90% (note: this is a definition, not the target)
- ☐ Renal - Creatinine > 170 micromol/L **or** Urine output <0.5ml/kg for 2 hours – despite adequate fluid resuscitation
- ☐ Liver - Bilirubin > 32 micromol/L
- ☐ Glucose > 7.7 mmol/L (in the absence of diabetes)
- ☐ Haematological - Platelets < 100 x 10^9/L
- ☐ Central Nervous System - Acutely altered mental status

One or more new organ dysfunction due to infection:

☐ **This is SEPSIS.** Inform Registrar, Consultant and Anaesthetics immediately. Reassess frequently in 1st hour. Consider other investigations and management +/- source control if patient does not respond to initial therapy as evidenced by haemodynamic stabilisation then improvement.

No new organ dysfunction due to infection:

☐ **This is NOT SEPSIS**: If infection is diagnosed proceed with usual treatment pathway for that infection.

Doctor's Initials

Section 11: Look for signs of septic shock

(following adequate initial fluid resuscitation, typically 2 litres in the first hour unless fluid intolerant)

AND

☐ Requiring inotropes/pressors to maintain MAP ≥ 65

☐ **This is SEPTIC SHOCK**

☐ Inform consultant

☐ Contact CRITICAL CARE/Anaesthesia

Doctor's Initials

Pathway Modification

All Pathway modifications need to be agreed by the Hospital's Sepsis Steering Committee and be in line with the National Clinical Guideline No 6 Sepsis Management.

Section 12

Clinical Handover. Use ISBAR$_3$ Communication Tool

This section only applies when handover occurs before the form is completed and is then signed off by the receiving doctor.

Doctor's Name (PRINT): Doctor's Signature: **Doctor's Initials** **MCRN**

Patient care handed over to: Time: Sections completed:

File this document in patient notes - Document management plan.

Doctor's Name: **Doctor's Signature:** **MCRN:** **Date:** **Time:**

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Sepsis Form - Emergency Department Adult

ALWAYS USE CLINICAL JUDGEMENT

There are separate sepsis criteria for maternity patients and children

EMERGENCY MEDICINE

RECOGNISE SEPSIS · ENHANCE SURVIVAL

Complete this form and apply if a patient presents to the Emergency Department with symptoms and/or signs of infection.

Section 1: Sepsis screen for Nursing Staff

Suspicion of infection ☐

AND

Patient presentation ☐ **1** ☐ **2 or** ☐ **3**

(see Section 3 and "Think Sepsis" poster).

If both identified, triage as Category 2/Orange and commence Sepsis Form

Addressograph here

Date: Triage Time: Triage Category:

Signature: NMBI PIN:

Section 2: Sepsis diagnosis for Medical Staff

Document site of suspected infection after medical review

- ☐ Respiratory Tract
- ☐ Intra-abdominal
- ☐ Urinary Tract
- ☐ Skin
- ☐ Catheter/Device Related
- ☐ Intra-articular/Bone
- ☐ Central Nervous System
- ☐ Unknown
- ☐ Other suspected site:

☐ **No clinical suspicion of INFECTION**: terminate form and sign at bottom.

Section 3:

Who needs to get the "Sepsis 6" – infection plus any one of the following:

1. ☐ Patients who present unwell who are on treatment that puts them at risk of neutropenia, e.g. on anti-cancer treatment.
2. ☐ Clinically apparent new onset organ failure, e.g. altered mental state, respiratory rate >30, hypoxia, heart rate ≥130, hypotension, oligo or anuria, non-blanching rash, pallor/mottling with prolonged capillary refill.
3. ☐ Patients with co-morbidities plus ≥2 SIRS criteria

Modified SIRS criteria: Note - physiological changes should be sustained ≥30mins.

- ☐ Respiratory rate ≥ 20 breaths/min
- ☐ WCC < 4 or > 12 x 10^9/L
- ☐ New onset confusion
- ☐ Heart rate > 90 beats/min
- ☐ Temperature <36 or >38.3°C
- ☐ Bedside glucose >7.7mmol/L *(in the absence of diabetes mellitus)*

Co-morbidities associated with increased mortality in sepsis.

- ☐ COPD
- ☐ DM
- ☐ Chronic liver disease
- ☐ Cancer
- ☐ Chronic kidney disease
- ☐ Immunosuppressant medications
- ☐ Age ≥75 years
- ☐ Frailty
- ☐ HIV/AIDS

Section 4

☐ **If YES** after medical review to Section 2 **PLUS** 1,2 or 3 in Section 3.

Start SEPSIS 6 (Section 6)

Time Zero:

Section 5

☐ **If NO** to infection with a high-risk presentation (1, 2 or 3), tick NO and sign off. If uncomplicated infection, continue usual infection treatment as appropriate and review diagnosis if patient deteriorates.

☐ **Infection**

Antimicrobial given:

Has a decision been made to apply a relevant treatment limitation plan.

☐ Do not proceed with Sepsis pathway. Document limitations in clinical notes.

Doctor's Name: **Doctor's Signature:**

MCRN: **Date:** **Time:**

Continue overleaf

Sepsis Form - ED Adult

ALWAYS USE CLINICAL JUDGEMENT

Version 2

Treatment, Risk Stratification and Escalation

Addressograph here

Section 6

TAKE 3 **SEPSIS 6 - aim to complete *within 1 hour*** **GIVE 3**

- ☐ **BLOOD CULTURES:** Take blood cultures prior to giving antimicrobials unless this leads to delay > 45minutes. Other cultures as indicated by history and examination.
- ☐ **BLOOD TESTS:** Point of care lactate (venous or arterial). FBC, U&E, LFTs +/- Coag. Other tests and investigations as indicated. Assess requirement for source control.
- ☐ **URINE OUTPUT:** Point of care urinalysis and assess urinary output as part of volume/perfusion status assessment. For patients with sepsis or septic shock start hourly urinary output measurement.

Doctor's Initials

- ☐ **OXYGEN: %.** Range 21% (R/A) to 100%. Titrate to saturations of 94-98%, 88-92% in chronic lung disease.
- ☐ **FLUIDS: Volume in 1st hour mls.** Range 0 to 2000mls typically. Assess volume status, if hypovolaemic/ hypoperfused bolus with 500mls isotonic balanced salt solution over 15 minutes and reassess. Continue up to 30mls/kg unless fluid intolerant and review. The aim is to replace any fluid deficit.
- ☐ **ANTIMICROBIALS:** Give antimicrobials as per local antimicrobial guideline based on the site of infection, community or healthcare associated infection and the patients allergy status.

Type: Dose: Time given:

Section 7:

Look for signs of new organ dysfunction – any one is sufficient:

- ☐ Lactate > 2 mmol/L (following adequate initial fluid resuscitation, typically 30mls/kg in the first hour unless fluid intolerant)
- ☐ Cardiovascular - Systolic BP < 90 or Mean Arterial Pressure (MAP) < 65 or Systolic BP more than 40 below patient's normal
- ☐ Respiratory - New need for oxygen to achieve saturation > 90% (note: this is a definition not the target)
- ☐ Renal - Creatinine > 170 micromol/L **or** Urine output <0.5ml/kg for 2 hours – despite adequate fluid resuscitation
- ☐ Liver - Bilirubin > 32 micromol/L
- ☐ Glucose > 7.7 mmol/L (in the absence of diabetes)
- ☐ Haematological - Platelets < 100 x 10^9/L
- ☐ Central Nervous System - Acutely altered mental status

One or more new organ dysfunction due to infection:

☐ **This is SEPSIS**: Seek senior input as per local guideline.

No new organ dysfunction due to infection:

☐ **This is NOT SEPSIS**: If infection is diagnosed proceed with usual treatment pathway for that infection.

Doctor's Initials

Section 8: Look for signs of septic shock
(following adequate initial fluid resuscitation, typically 2 litres in the first hour unless fluid intolerant)

AND

- ☐ Requiring inotropes/pressors to maintain MAP ≥ 65

☐ **This is SEPTIC SHOCK**

- ☐ Inform consultant
- ☐ Contact CRITICAL CARE

Doctor's Initials

Practical Guidance

Re-assess the patient's clinical response frequently. Re-assess and repeat lactate, if the first is abnormal, by 3hrs. Achieve MAP ≥65mmHg by 6hrs and/or have started pressors.
Achieve source control, if required, at the earliest opportunity. Use clinical judgement. If the patient is deteriorating, despite appropriate treatment, seek senior assistance and re-asssess antimicrobial therapy.

Pathway Modification

All Pathway modifications need to be agreed by the Hospital's Sepsis Committee and be in line with the National Clinical Guideline.

Section 9

Clinical Handover. Use ISBAR$_3$ Communication Tool

This section only applies when handover occurs before the form is completed and the form is then signed off by the receiving doctor.

Doctor's Name (PRINT): Doctor's Signature: **Doctor's Initials** **MCRN**

Patient care handed over to: Time: Sections completed:

Form completed by

Doctor's Name: **Doctor's Signature:**

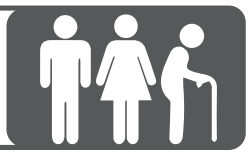
MCRN: **Date:** **Time:**

File this document in the patient notes – other aspects of patient management should be documented on the continuation sheets.

Sepsis Form - In-Patient Adult

Start Sepsis form if there is a suspicion of infection and NEWS ≥4 or there is clinical concern

ALWAYS USE CLINICAL JUDGEMENT There are separate sepsis criteria for maternity patients and children



Section 1: Sepsis screen for Nursing Staff

Suspicion of infection ☐

AND

Patient presentation ☐ **1** ☐ **2 or** ☐ **3**
(see Section 3 and "Think Sepsis" poster).

Action: Medical review within 30 mins

Addressograph here

Date: Time of NEWS: NEWS:

Signature: NMBI PIN:

Section 2: Sepsis diagnosis for Medical Staff

Document site of suspected infection after medical review

- ☐ Respiratory Tract
- ☐ Intra-abdominal
- ☐ Urinary Tract
- ☐ Skin
- ☐ Catheter/Device Related
- ☐ Intra-articular/Bone
- ☐ Central Nervous System
- ☐ Unknown
- ☐ Other suspected site:

☐ **No clinical suspicion of INFECTION**: terminate form and sign at bottom.

Section 3:

Who needs to get the "Sepsis 6" – infection plus any one of the following:

1. ☐ Patients who present unwell who are on treatment that puts them at risk of neutropenia, e.g. on anti-cancer treatment.
2. ☐ Clinically apparent new onset organ failure, e.g. altered mental state, respiratory rate >30, hypoxia, heart rate ≥130, hypotension, oligo or anuria, non-blanching rash, pallor/mottling with prolonged capillary refill.
3. ☐ Patients with co-morbidities plus ≥2 SIRS criteria

Modified SIRS criteria: Note - physiological changes should be sustained ≥30mins.

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- ☐ New onset confusion
- ☐ Heart rate > 90 beats/min
- ☐ Temperature <36 or >38.3^{0}C
- ☐ Bedside glucose >7.7mmol/L *(in the absence of diabetes mellitus)*

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- ☐ COPD
- ☐ DM
- ☐ Chronic liver disease
- ☐ Cancer
- ☐ Chronic kidney disease
- ☐ Immunosuppressant medications
- ☐ Age ≥75 years
- ☐ Frailty
- ☐ HIV/AIDS

Section 4

☐ **If YES** after medical review to Section 2 **PLUS** 1,2 or 3 in Section 3.

Start SEPSIS 6 (Section 6)

Time Zero:

Section 5

☐ **If NO** to infection with a high-risk presentation (1, 2 or 3), tick NO and sign off. If uncomplicated infection, continue usual infection treatment as appropriate and review diagnosis if patient deteriorates.

☐ **Infection**

Antimicrobial given:

Has a decision been made to apply a relevant treatment limitation plan.

☐ Do not proceed with Sepsis pathway. Document limitations in clinical notes.

Doctor's Name: **Doctor's Signature:**

MCRN: **Date:** **Time:**

Continue overleaf

Sepsis 3 Form In-Patient - 18/08/2017

Sepsis Form - In-Patient Adult

ALWAYS USE CLINICAL JUDGEMENT

Version 2

Treatment, Risk Stratification and Escalation

Addressograph here

Section 6 **TAKE 3** **SEPSIS 6 - aim to complete *within 1 hour*** **GIVE 3**

- ☐ **BLOOD CULTURES:** Take blood cultures prior to giving antimicrobials unless this leads to delay > 45minutes. Other cultures as indicated by history and examination.
- ☐ **BLOOD TESTS:** Point of care lactate (venous or arterial). FBC, U&E, LFTs +/- Coag. Other tests and investigations as indicated. Assess requirement for source control.
- ☐ **URINE OUTPUT:** Point of care urinalysis and assess urinary output as part of volume/perfusion status assessment. For patients with sepsis or septic shock start hourly urinary output measurement.

Doctor's Initials

- ☐ **OXYGEN: %.** Range 21% (R/A) to 100%. Titrate to saturations of 94-98%, 88-92% in chronic lung disease.
- ☐ **FLUIDS: Volume in 1st hour mls.** Range 0 to 2000mls typically. Assess volume status, if hypovolaemic/ hypoperfused bolus with 500mls isotonic balanced salt solution over 15 minutes and reassess. Continue up to 30mls/kg unless fluid intolerant and review. The aim is to replace any fluid deficit.
- ☐ **ANTIMICROBIALS:** Give antimicrobials as per local antimicrobial guideline based on the site of infection, community or healthcare associated infection and the patients allergy status.

Type: Dose: Time given:

Section 7:

Look for signs of new organ dysfunction – any one is sufficient:

- ☐ Lactate > 2 mmol/L (following adequate initial fluid resuscitation, typically 30mls/kg in the first hour unless fluid intolerant)
- ☐ Cardiovascular - Systolic BP < 90 or Mean Arterial Pressure (MAP) < 65 or Systolic BP more than 40 below patient's normal
- ☐ Respiratory - New need for oxygen to achieve saturation > 90% (note: this is a definition not the target)
- ☐ Renal - Creatinine > 170 micromol/L **or** Urine output <0.5ml/kg for 2 hours – despite adequate fluid resuscitation
- ☐ Liver - Bilirubin > 32 micromol/L
- ☐ Glucose > 7.7 mmol/L (in the absence of diabetes)
- ☐ Haematological - Platelets < 100 x 10^9/L
- ☐ Central Nervous System - Acutely altered mental status

One or more new organ dysfunction due to infection:

☐ **This is SEPSIS**: Seek senior input as per local guideline.

No new organ dysfunction due to infection:

☐ **This is NOT SEPSIS**: If infection is diagnosed proceed with usual treatment pathway for that infection.

Doctor's Initials

Section 8: Look for signs of septic shock
(following adequate initial fluid resuscitation, typically 2 litres in the first hour unless fluid intolerant)

AND

- ☐ Requiring inotropes/pressors to maintain MAP ≥ 65

☐ **This is SEPTIC SHOCK**

- ☐ Inform consultant
- ☐ Contact CRITICAL CARE

Doctor's Initials

Practical Guidance

Re-assess the patient's clinical response frequently. Re-assess and repeat lactate, if the first is abnormal, by 3hrs. Achieve MAP ≥65mmHg by 6hrs and/or have started pressors.
Achieve source control, if required, at the earliest opportunity. Use clinical judgement. If the patient is deteriorating, despite appropriate treatment, seek senior assistance and re-asssess antimicrobial therapy.

Pathway Modification

All Pathway modifications need to be agreed by the Hospital's Sepsis Committee and be in line with the National Clinical Guideline.

Section 9

Clinical Handover. Use ISBAR$_3$ Communication Tool

This section only applies when handover occurs before the form is completed and the form is then signed off by the receiving doctor.

Doctor's Name (PRINT): Doctor's Signature: **Doctor's Initials** **MCRN**

Patient care handed over to: Time: Sections completed:

Form completed by

Doctor's Name: **Doctor's Signature:**

MCRN: **Date:** **Time:**

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References

1. Singer et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA 2016;315(8):801-810
2. Rhodes et al. Surviving Sepsis Campaign: International Guidelines for management of Sepsis and Septic Shock: 2016. CCM. 2017; Mar Vol 45(8): 486-552.
3. Fleischmann et al. 'Hospital Incidence and Mortality Rates of Sepsis, An analysis of hospital episode (DRG) statistics in Germany from 2017 to 2013'. Dtsch Arztebl, 2016, Mar; 113 (10): 159 -166
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Notes

www.hse.ie/sepsis