Critical Care
Ebola Virus Disease

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Intensive Care Med
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UNDERSTANDING THE DISEASE

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Robert A. Fowler
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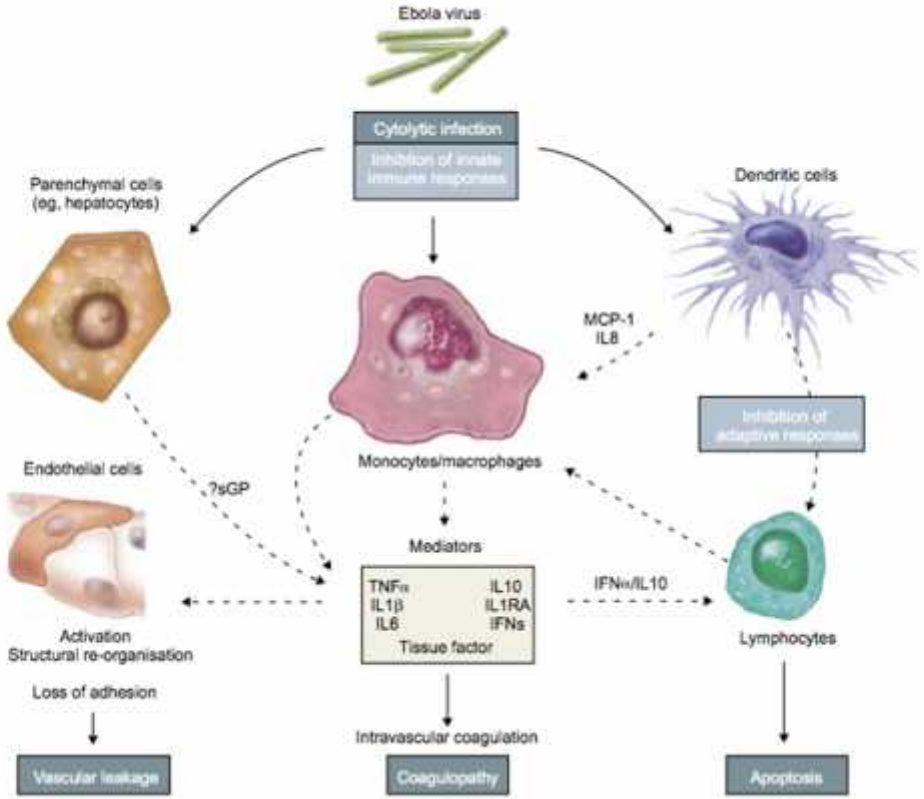
Understanding organ dysfunction in Ebola virus disease



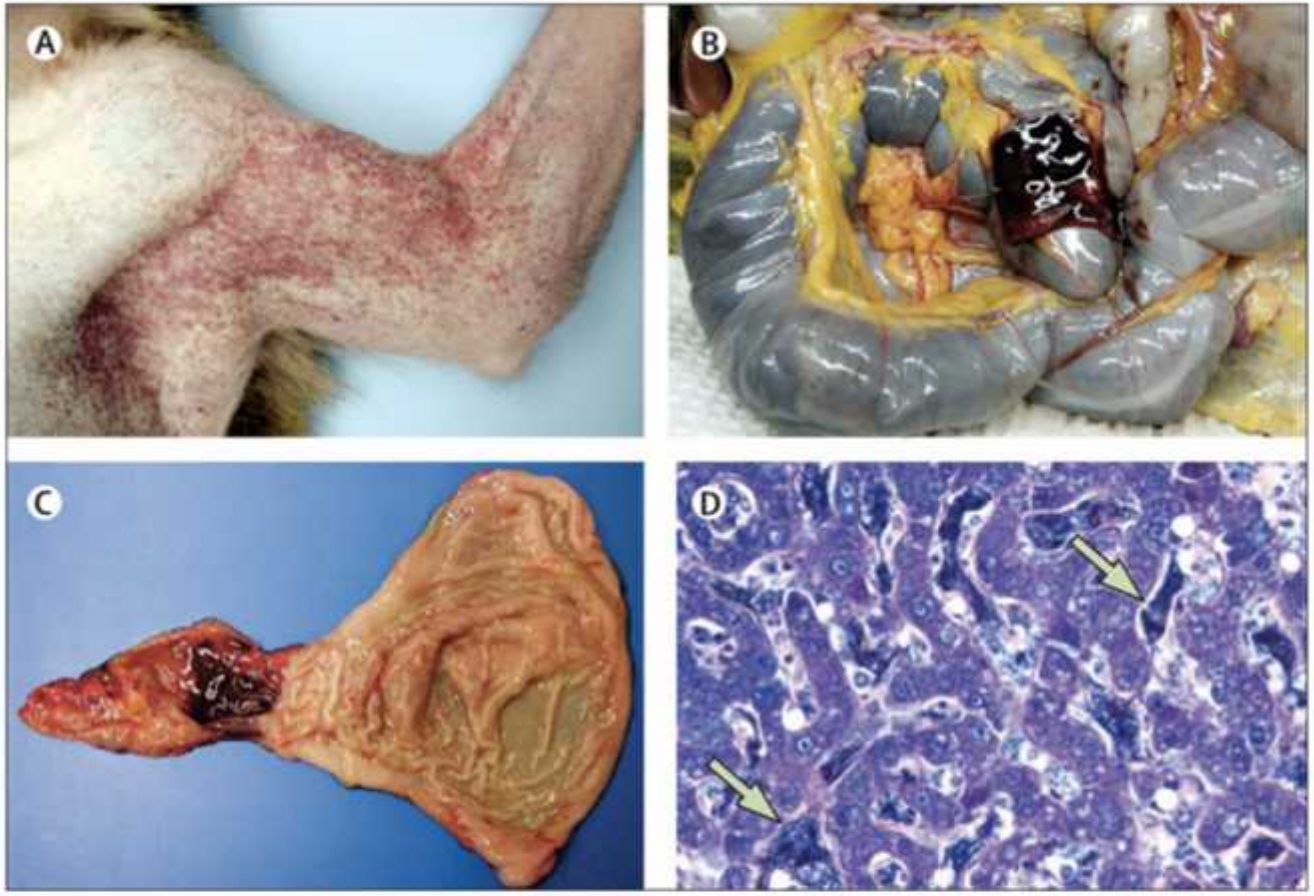


Figure 3. Haemorrhagic manisfestations noted in non-human primates infected with Ebola virus
Petechiae on the arm and axillary region of a Cynomolgus monkey infected with Sudan Ebola virus (A). Also shown are haemorrhages in the ileum (B) and a gastroduodenal lesion (C) from a Cynomolgus monkey infected with Sudan Ebola virus and fibrin thrombi (arrows) in sinusoids of a rhesus monkey infected with Zaire Ebola virus (D).

Lancet. 2011 March 5; 377(9768): 849–862.

Ebola Virus Disease in West Africa — Clinical Manifestations and Management

Daniel S. Chertow, M.D., M.P.H., Christian Kleine, M.D., Jeffrey K. Edwards, M.D., M.P.H., Roberto Scaini, M.D., Ruggero Giuliani, M.D., and Armand Sprecher, M.D., M.P.H.

Clinical Features of Ebola Virus Disease.

Phase of Illness	Time since Symptom Onset	Clinical Features
Early febrile	0–3 days	Fever, malaise, fatigue, body aches
Gastrointestinal	3–10 days	Primary: epigastric pain, nausea, vomiting, diarrhea Associated: persistent fever, asthenia, headache, conjunctival injection, chest pain, abdominal pain, arthralgias, myalgias, hiccups, delirium
Shock or recovery	7–12 days	Shock: diminished consciousness or coma, rapid thready pulse, oliguria, anuria, tachypnea Recovery: resolution of gastrointestinal symptoms, increased oral intake, increased energy
Late complications	≥10 days	Gastrointestinal hemorrhage, secondary infections, meningoencephalitis, persistent neurocognitive abnormalities*

* Secondary infections are presumptive diagnoses based on clinical features of distributive shock, oral or esophageal candidiasis, and oral ulcers; meningoencephalitis is a presumptive diagnosis based on clinical features of unconsciousness and stiff neck.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Clinical Presentation of Patients with Ebola Virus Disease in Conakry, Guinea

Elhadj Ibrahima Bah, M.D., Marie-Claire Lamah, M.D., Tom Fletcher, M.R.C.P., Shevin T. Jacob, M.D., M.P.H., David M. Brett-Major, M.D., M.P.H., Amadou Alpha Sall, Ph.D., Nahoko Shindo, M.D., Ph.D., William A. Fischer II, M.D., Francois Lamontagne, M.D., Sow Mamadou Saliou, M.D., Daniel G. Bausch, M.D., M.P.H.&T.M., Barry Moumié, M.D., Tim Jagatic, M.D., Armand Sprecher, M.D., James V. Lawler, M.D., M.P.H., Thierry Mayet, M.D., Frederique A. Jacquerioz, M.D., María F. Méndez Baggi, M.D., Constanza Vallenas, M.D., Christophe Clement, M.D., Simon Mardel, M.D., Ousmane Faye, Ph.D., Oumar Faye, Ph.D., Baré Soropogui, Pharm.D., Nfaly Magassouba, D.V.M., Ph.D., Lamine Koivogui, Pharm.D., Ph.D., Ruxandra Pinto, Ph.D., and Robert A. Fowler, M.D.C.M.

Table 2. Therapies Received by 37 Patients Hospitalized for EVD.

Therapy	Value
Oral rehydration solution — no. (%)	36 (97)
Intravenous fluids — no. (%)	28 (76)
Median volume of crystalloid solution administered in first 24 hr (IQR) — liters	1 (1–1)
Antibiotic treatment — no. (%)	
Any	37 (100)
Ciprofloxacin	20 (54)
Ceftriaxone	13 (35)
Cefixime	5 (14)
Amoxicillin–clavulanic acid	1 (3)
Antimalarial treatment — no. (%)	7 (19)
Supplemental oxygen therapy — no. (%)	1 (3)

Table 3. Clinical Complications and Outcomes for 37 Patients with EVD.

Variable	Value
Hospital mortality — no. (%)	16 (43)
Median length of stay in hospital (IQR) — days	8 (6–11)
Known complications in hospital — no. (%)	
Hemorrhage	
Any	19 (51)
Gastrointestinal	9 (24)
Subconjunctival	4 (11)
Intravenous catheter site	4 (11)
Nasorespiratory tract	2 (5)
Renal failure*	2 (5)
Seizure	2 (5)
Oral candidiasis	1 (3)
Hypoxemia	1 (3)

* Renal failure was defined as a serum creatinine level of more than 4 mg per deciliter (350 μmol per liter).

Bah et al NEJM Nov 2014

The NEW ENGLAND JOURNAL of MEDICINE

BRIEF REPORT

A Case of Severe Ebola Virus Infection Complicated by Gram-Negative Septicemia

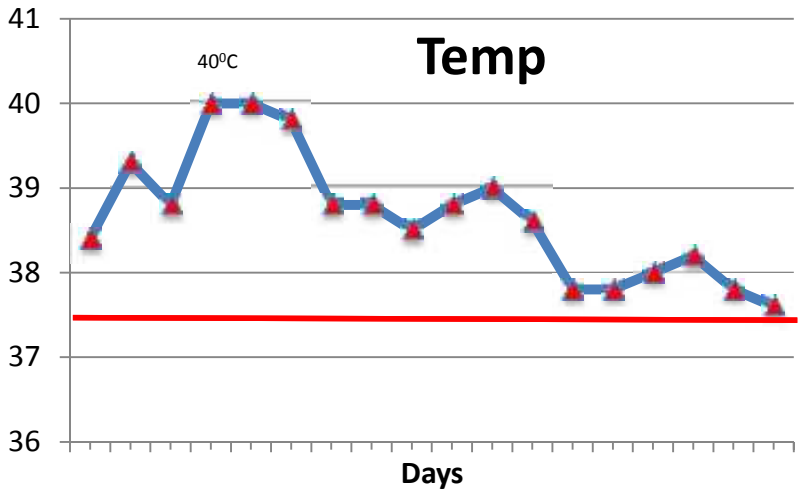
Benno Kreuels, M.D., Dominic Wichmann, M.D., Petra Emmerich, Ph.D., Jonas Schmidt-Chanasit, M.D., Geraldine de Heer, M.D., Stefan Kluge, M.D., Abdourahmane Sow, M.D., Thomas Renné, M.D., Ph.D., Stephan Günther, M.D., Ansgar W. Lohse, M.D., Marylyn M. Addo, M.D., Ph.D., and Stefan Schmiedel, M.D.

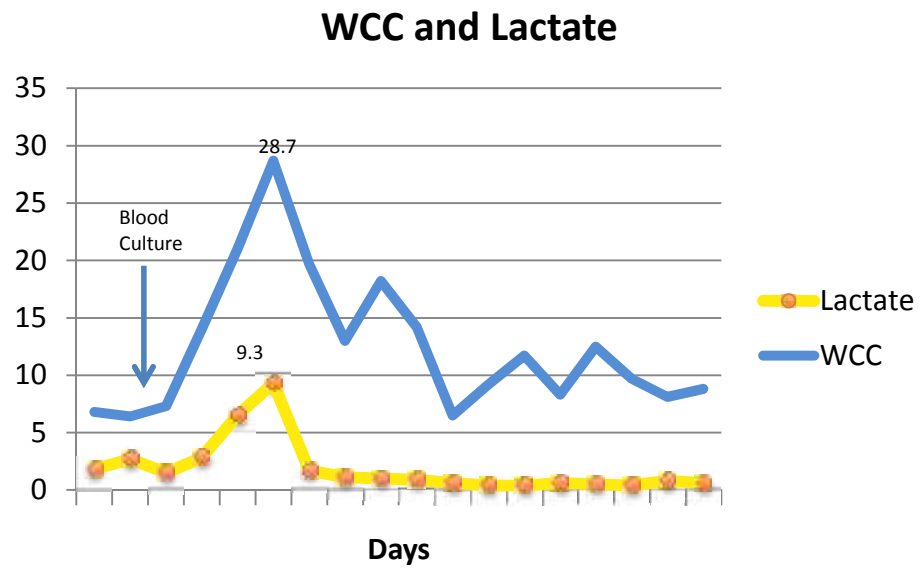
Table S2: Physical examination on admission

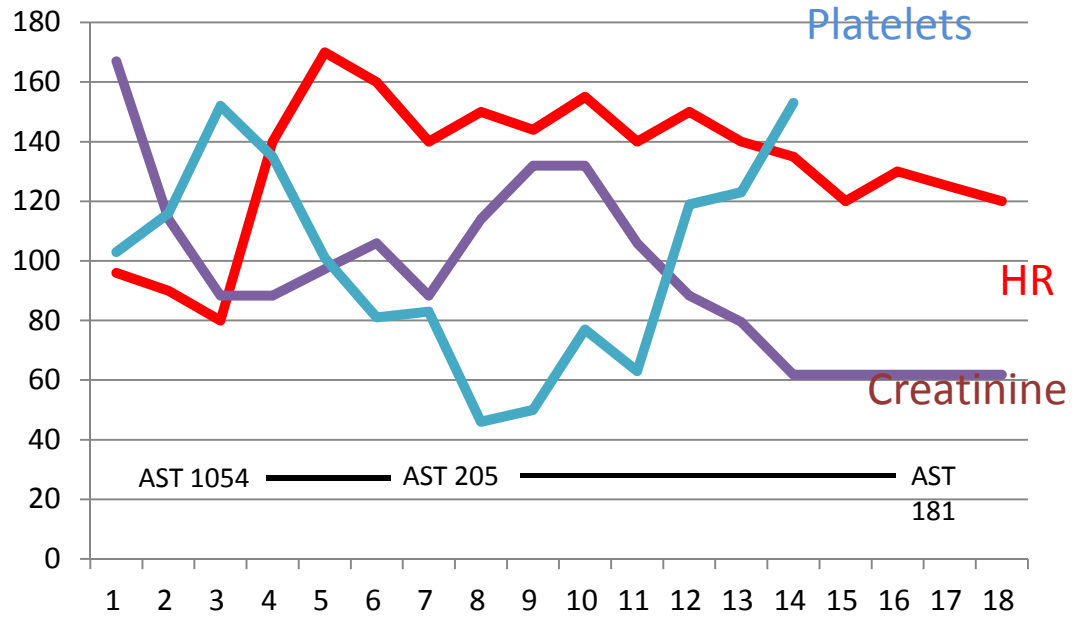
VITALS	H: 179 cm, W: 75 kg. GCS 15/15, SpO_2 97%, RR 110/80, HR 87 bpm
GENERAL	Awake and responsive, ambulatory without assistance.
HEENT	No scleral icterus or conjunctival bleeding. Pupils isochroous and reactive to light and accommodation. No enanthema. Dry mucosal membranes.
NECK	Supple, no abnormalities detected
HEART AND LUNGS	auscultation and percussion not possible.[1]
ABDOMEN	Soft, mild tenderness to palpation, percussion and auscultation not possible.[1]
EXTREMITIES	No edema, erythema or calf pain bilaterally.
SKIN	No rashes noted on extremities, chest, abdomen, or back. No petechia or purpura.
NEUROLOGICAL	Able to stand, walk and moving all extremities, no focal neurological deficits, CN II-XII grossly intact. limited exam.

[1]Due to the personal protective equipment worn in the unit, the use of stethoscopes was not possible and there were some limitations to full physical examination.

Benno et al. NEJM Oct 2014

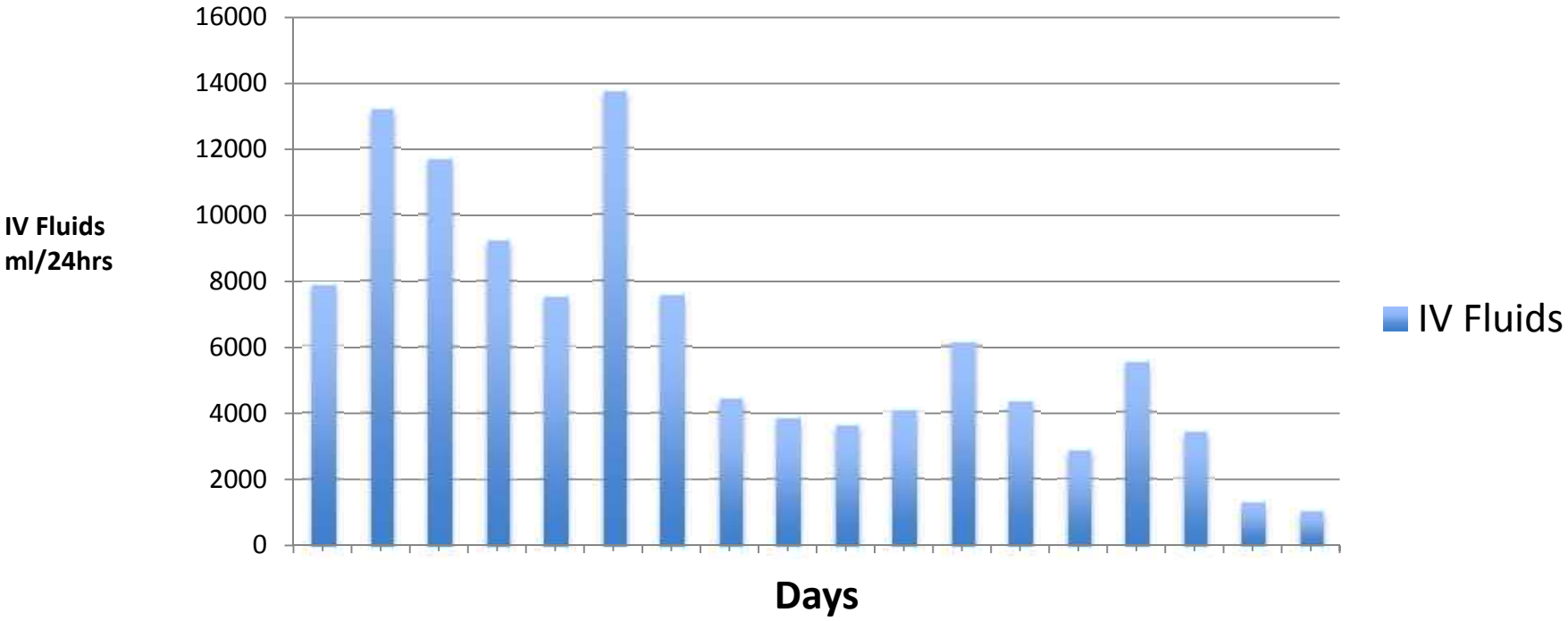






Hamburg day 1 / day 10 illness

Benno et al. NEJM Oct 2014



Benno et al. NEJM Oct 2014

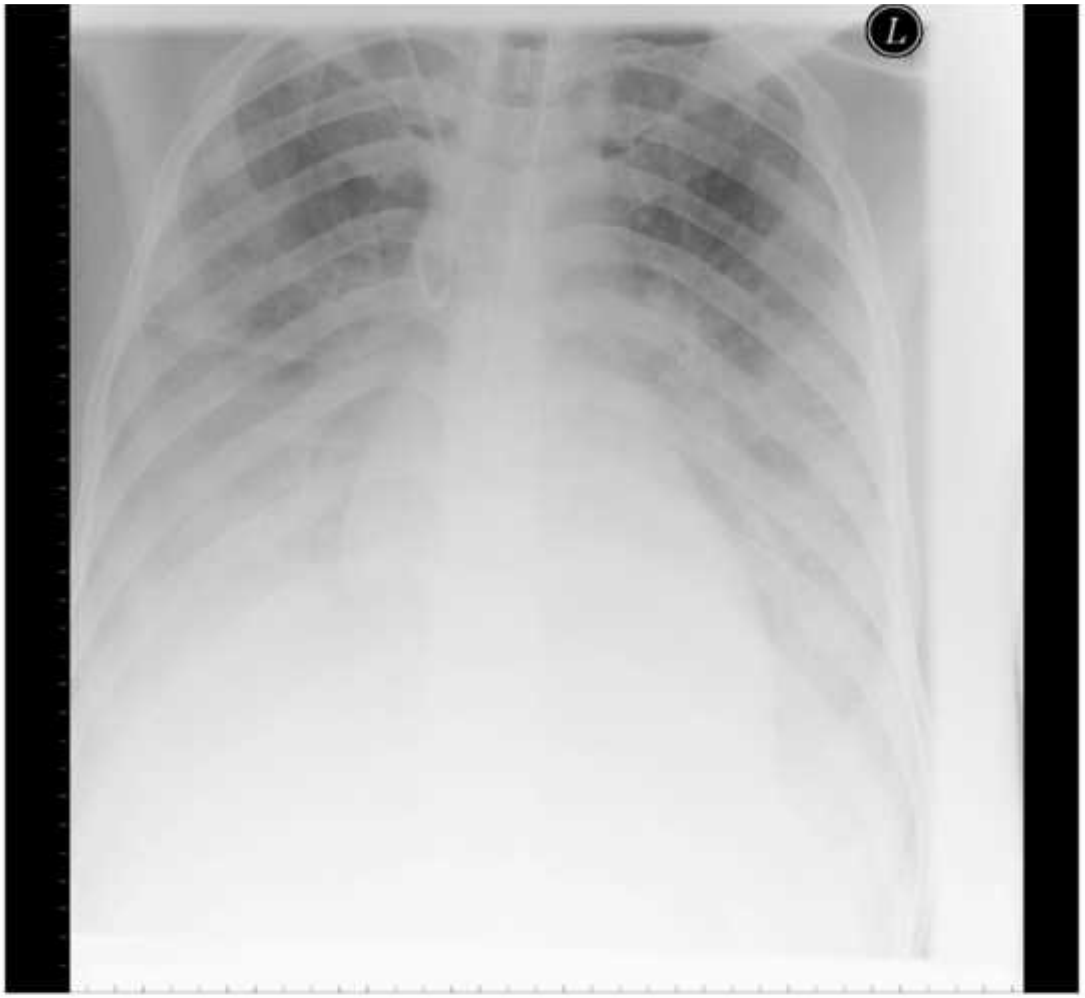


Figure S4. Chest X-ray on day of illness 16

Compared to the image taken on day of illness 15, bedside CXR shows newly developed bilateral pleural effusions, increased cardiac congestion and atelectasis. A gastric tube displayed in correct anatomic position.

+ blood aspiration

NIV for 8 days from day 18 of illness

$Sa0_2$ < 85% x 5 days

Benno et al. NEJM Oct 2014

Table S3: Ultrasound examination on admission

LIVER	normal aspect and size without focal lesions, no cholestasis, all liver vessels with orthograde flow.
SPLEEN	normal aspect and size
KIDNEYS AND BLADDER	both kidneys of normal aspect and size, no obstruction of the urinary tract
INTESTINAL TRACT	pronounced edema of the stomach, small intestine and large intestinal wall. Extremely distended intestinal loops, with large amounts of intra-intestinal fluids and complete absence of peristaltic movement
LYMPH NODES	mesenterial lymph nodes enlarged
ABDOMINAL VESSELS	complete collapse of the inferior Vena Cava (IVC)
No signs of pericardial effusion, pleural effusion or ascites	

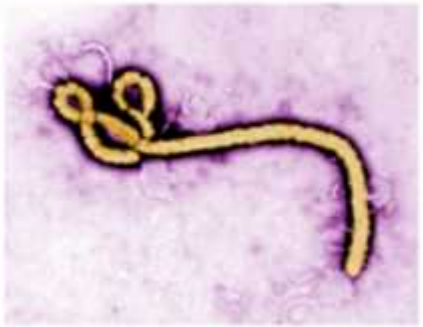
Benno et al. NEJM Oct 2014

Canadian Critical Care Society
Canadian Assoc. of Emergency Physicians
Assoc. of Medical Microbiology & Infectious Diseases Canada

Ebola Clinical Care Guidelines

A guide for clinicians in Canada

Report #2 – Updated: October 28, 2014



Organized by the Public Health Agency of Canada

Treatment

The mainstay of treatment is supportive care, which includes careful attention to intravascular volume status and oral or intravenous fluid therapy, correction of electrolyte and metabolic abnormalities, correction of coagulation abnormalities, nutritional support, and antibiotics for secondary bacterial infections. Although robust data are still lacking, anecdotal experience from EVD patients treated both Africa and 'Western' health care systems during the current outbreak suggests that the mortality rate associated with EVD can be significantly reduced through the provision of supportive care, and in particular critical care.

Intensive Care Society of Ireland

Information

for

Critical Care Management of the Adult Patient

In Ireland with

Ebola Virus Disease 2014

Report of :

Critical Care Advisory Group on Ebola Virus Disease

Intensive Care Society of Ireland

Interim Guidelines 28th October 2014

(to be updated with evolving international guidelines)

www.icmed.com

Advisory Group

Dr B Marsh	Chair ICSI Advisory Group
	Mater Misericordiae University Hospital
Dr C O'Loughlin	Mater Misericordiae University Hospital
Dr J Moriarty	St. James's Hospital
Dr I M-Loeches	St. James's Hospital
Dr D Collins	St. James's Hospital
Dr G Fitzpatrick	Adelaide and Meath Hospital Dublin
Dr M Donnelly	Adelaide and Meath Hospital Dublin
Dr A Westbrook	St.Vincent's University Hospital
Dr P Neligan	University College Hospital Galway
Dr M Power	Beaumont Hospital
Dr R Dwyer	Beaumont Hospital
Dr R Plant	Cork University Hospital
Dr V Hamilton	University Hospital Waterford
Dr C Nix	University Hospital Limerick
Dr J O'Dea	University Hospital Limerick
Dr K Carson	Children's University Hospital, Temple St.

The information in this document is designed to draw together available guidelines and information to assist the critical care clinical teams access relevant materials. Best clinical practice remains the responsibility of each doctor caring for these patients. When better information becomes available regarding specific therapies for this disease in an ICM context, these shall be added to this information resource.

Critical Care Scope

Context:

Full PPE training and NIU environment training

Specialist Roles:

Critical Care Medicine - advice, assessment, early intervention and prevention of organ failures, diagnostic (eg. US), procedural (eg.CVC)

Critical Care Nursing - skill mix re level 2 / 3 ICM

Symptom	Aetiology	Management	Procedural
Hypotension and shock	Hypovolaemia 2^{o} to GI losses; secondary infection; SIRS	Close fluid balance. Aggressive fluid resus. Electrolyte replacement K, Ca. Assess fluid responsiveness. Consider Vasopressors.	Consider CVC - K+ replacement - Vasopressors - Difficult IV access - $ScvO_2$ Ultrasound Guided Senior Clinician
Severe vomiting / diarrhoea	Early in disease	NGT Ondansetron Haloperidol Metoclopramide ? Rectal tube	Caution re NGT and/or faecal collection system with coagulation abnormalities
Dyspnoea or Respiratory Failure	Late in disease.	0_2 ?NIV ?Intubation & mechanical ventilation. ? Bacterial infection ? Blood aspiration	Adjunctive Strategies Hepa filtration - Ambu / C-Circuit - Expired gasses Senior Clinician Protective ventilation strategies.
Seizure / Coma	Ominous and late	Medical management of seizures. Check Na+, glucose	
Intolerant of PO	Vomiting	Enteral Nutrition if tolerated Parenteral Nutrition	PN usually mandates CVC

Symptom	Aetiology	Management	Procedural
Renal failure	Hypovolaemia. DIC	Close fluid balance. Aggressive fluid resus. ? CRRT ? IHD	Vascath. Considerations: CRRT Complexities IHD case suitability CDC Guidelines re dialysis Ultrasound Guided Senior Clinician
Liver dysfunction	Common in severe cases. Maybe early in disease	Monitor LFTs Coagulation Consider Vit K Beware hypoglycaemia	
Haemorrhage	Late in disease. DIC	Correct coagulation abnormalities. Target Hb 7g/dl Blood Bank EVD protocol	
CPR		Patient Context Patient wishes	Ability to provide safe and effective CPR
Pain	Abdomen, joint, chest wall	Symptomatic medical	

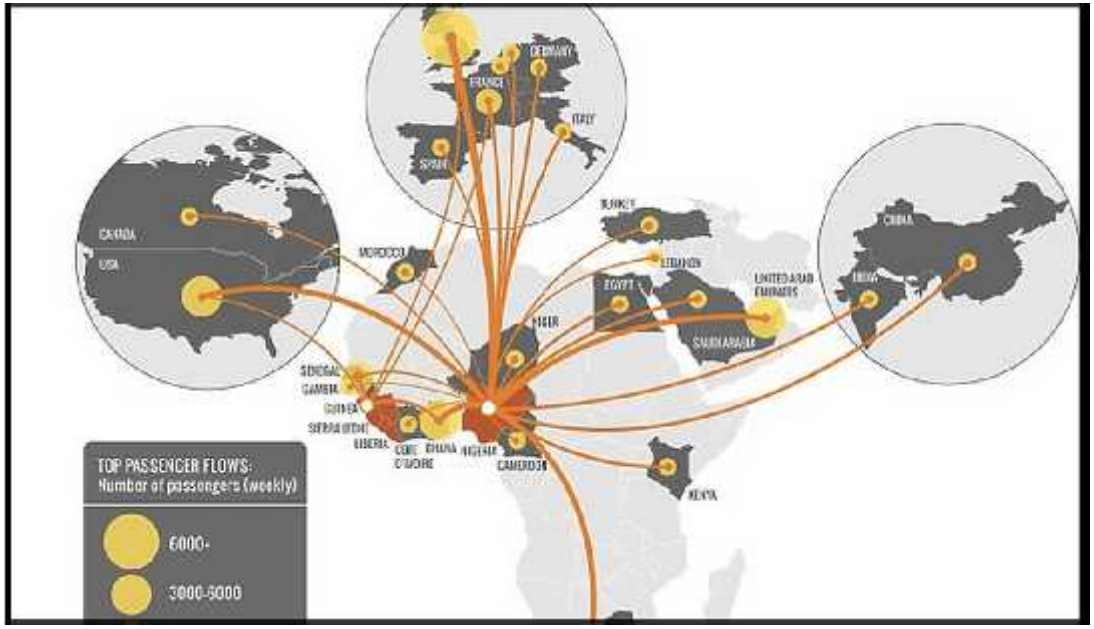

EMORY news center
Ebola

ICU Team

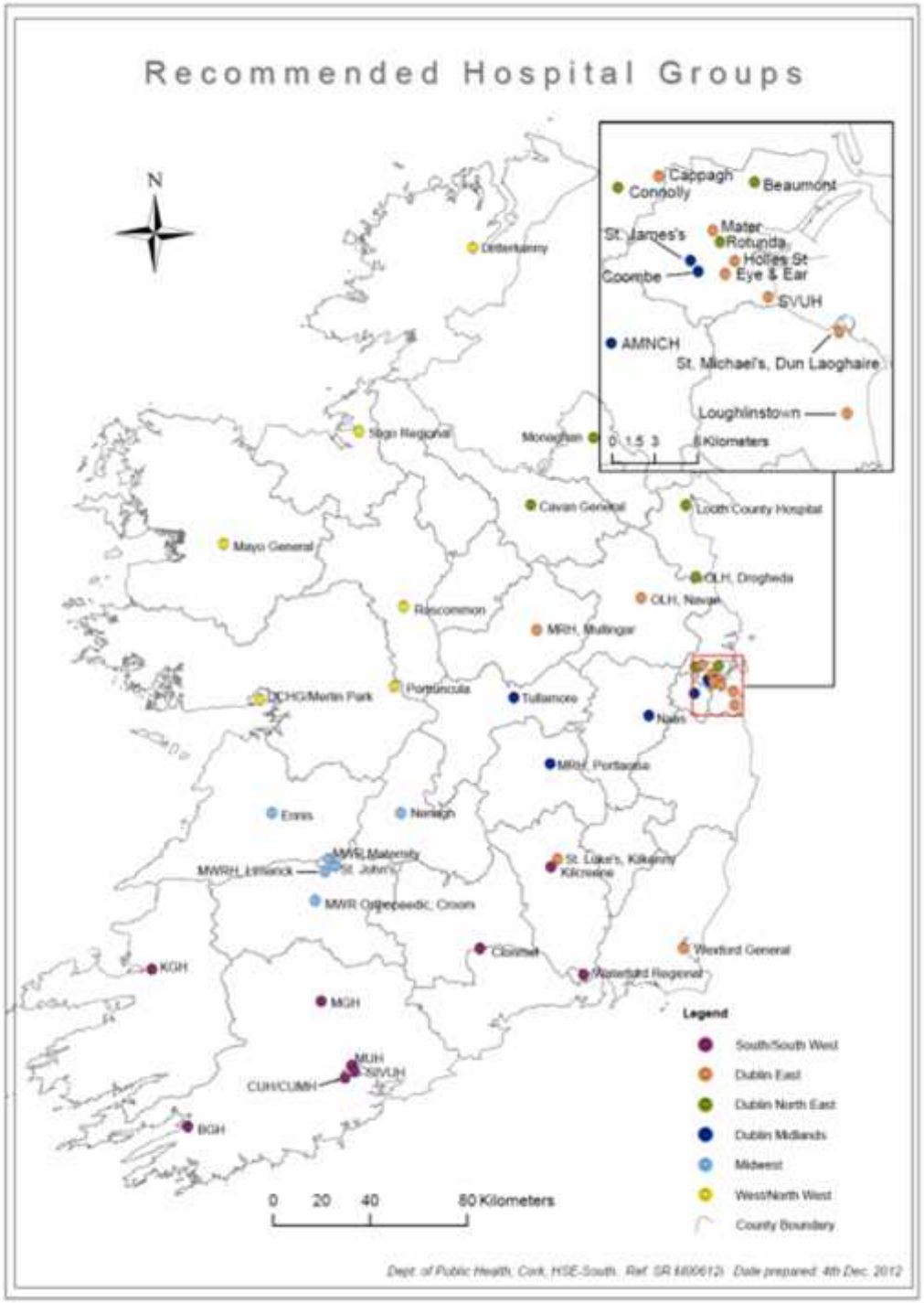
Patient resuscitative / care needs unique but identifiable and within skillmix.

Environment and PPE – Complex

Ideally, one center only.

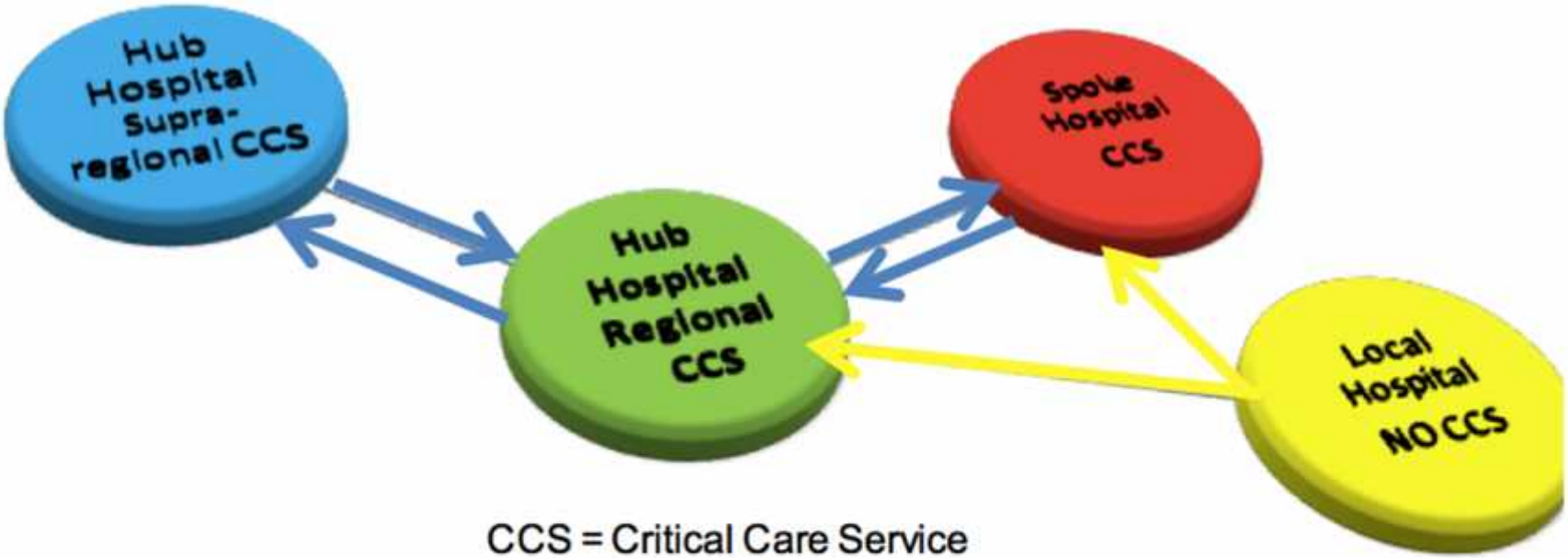

GERMANY
FRANCE
ITALY
SPAIN
CANADA
USA
MOROCCO
TURKEY
LIBYA
EGYPT
UNITED ARAB EMIRATES
SAUDI ARABIA
CHINA
INDIA
NIGER
SENEGAL
GAMBIA
GUINEA
SIERRA LEONE
LIBERIA
CÔTE D'IVOIRE
GHANA
NIGERIA
CAMEROON
KENYA
TOP PASSENGER FLOWS:
Number of passengers (weekly)
6000+
3000-5000


Infeksjonspost A
AMBULANSE
UVI MOVIL


Recommended Hospital Groups
N
Cappagh
Connolly
Beaumont
St. James's
Mater
Rotunda
Holles St
Coombe
Eye & Ear
SVUH
AMNCH
St. Michael's, Dun Laoghaire
Loughlinstown
0 1.5 3 6 Kilometers
Letterkenny
Sligo Regional
Monaghan
Cavan General
Louth County Hospital
Mayo General
OLH, Drogheda
OLH, Navan
Roscommon
MRH, Mullingar
Portiuncula
DCHG/Merlin Park
Tullamore
Naas
MRH, Portlaoise
Ennis
Nenagh
MWRH, Ennistimon
St. John's
St. Luke's, Kilkenny
Kilcreene
MWR Orthopaedic, Croom
Clonmel
Wexford General
Waterford Regional
KGH
MGH
MUH
CUH/CUMH
SIVUH
BGH
0 20 40 80 Kilometers
Legend
South/South West
Dublin East
Dublin North East
Dublin Midlands
Midwest
West/North West
County Boundary
Dept. of Public Health, Cork, HSE-South. Ref: SR 680612. Date prepared: 4th Dec. 2012

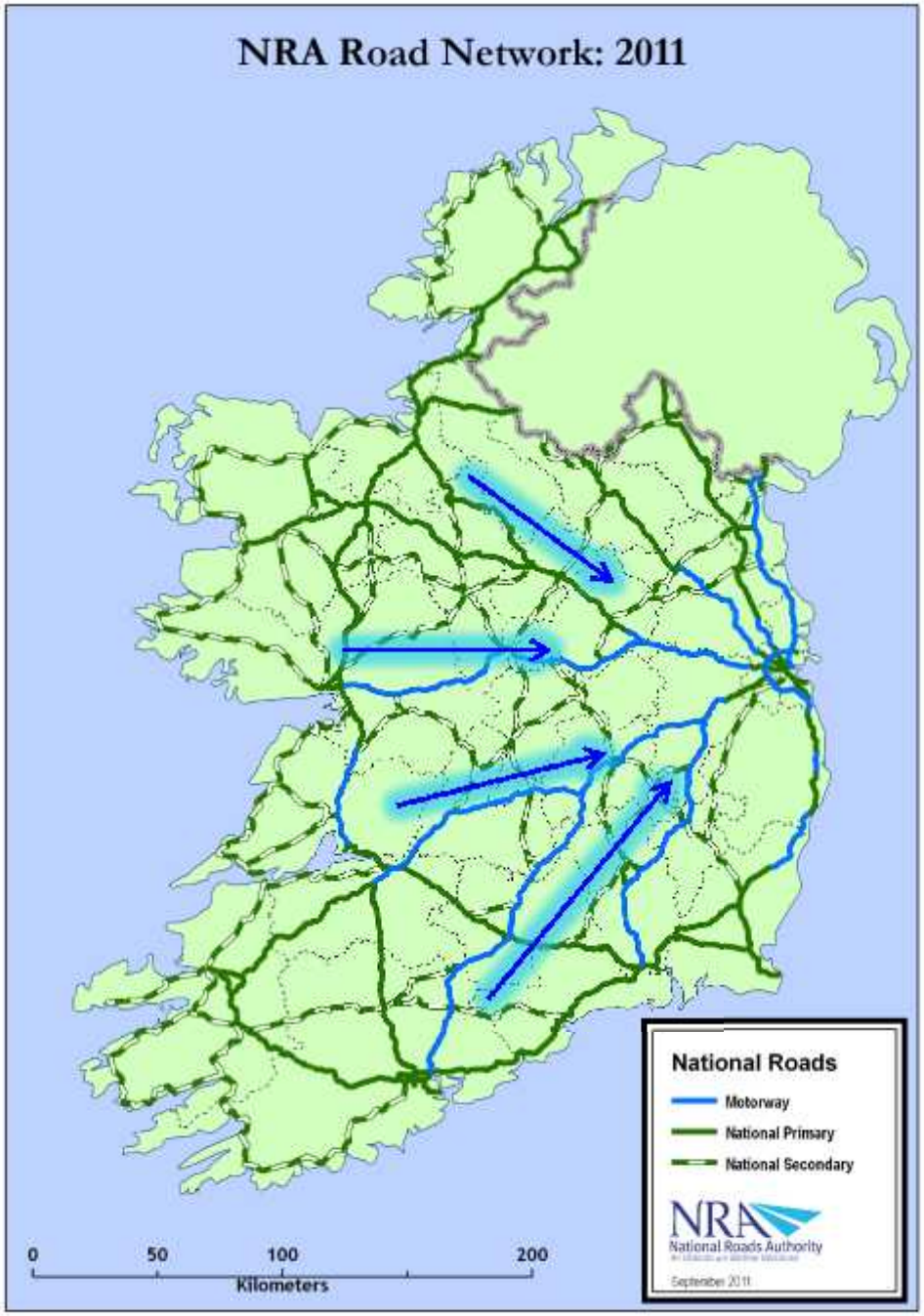
Critical Care Programme
Critical Care 'hub-and-spoke' Model

Tús Áite do Shábháilteacht Othar
Patient Safety First



CCS = Critical Care Service

Critical Care Retrieval- safe inter-hospital critically ill patient transport



Critical Care Retrieval EVD

Volunteer Consultant Rota
Based from Dublin
Collaborative Training
Critical Care Referral

Critical Care EVD “hub & spoke”