

Business and Continuity of Operations

Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

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e-Appendix 1: Appendix Shortages of Critical Care Medications in the United States 2010 (Source: American Society of Health-System Pharmacists www.ashp.org)

e-Table 1. Shortages of Critical Care Medications in the United States 2010 – 2013 (Source American Society of Health-System Pharmacists www.ashp.org)

Generic Name	Category	Manufacturer(s) and product in shortage	Alternative Source / Formulations Available	Alternative medications of similar route and mechanism of action	Start of Shortage	End of Shortage
Fentanyl Injection	Analgesic	Akorn (50mcg/mL 2 mL ampules 10 and 25 counts, 50mcg/mL 5 mL ampules 10 and 25 counts, 50mcg/mL 20 mL ampules), Hospira (50mcg/mL 5 mL, 10 mL, and 20 mL ampules, 50mcg/mL 2 mL, 10 mL, and 50 mL vials, 50mcg/mL 2 ML Carpuject syringe), West-Ward (50mcg/mL 2 mL and 50 mL vials, 50mcg/mL 5 mL and 20 mL ampules)	Yes	alfentanil, sufentanil, remifentanil, dilaudid, hydromorphone, morphine	11/2/2011	ongoing
Hydromorphone Hydrochloride Injection	Analgesic	Purdue (250 mg vial powder for injection, 10mg/mL 50 mL vials), Hospira (2mg/mL 1 mL vial)	Yes	alfentanil, sufentanil, remifentanil, fentanyl, dilaudid, morphine	5/31/2011	ongoing

Ketorolac Tromethamine Injection	Analgesic	West-Ward (15mg/mL 1 mL vial 25 count, 30mg/mL 1 mL vial 25 count, 30mg/mL 2 mL vial for IM use 25 count), Bedford (15mg/mL 1 mL vial 10 count, 30mg/mL 1 mL vial 10 count, 30mg/mL 10 mL vial 10 count, 30mg/mL 2 mL vial for IM use 10 count), Hospira (15mg/mL 1 mL vial 25 count, 15mg/mL 1 mL Novaplus vial 25 count, 30mg/mL 2 mL vials for IM use 10 count), Wockhardt (15mg/mL 1 mL vial 10 count and 25 count, 30mg/mL 1 mL vial 10 count and 25 count)	Yes	none	1/28/2011	ongoing
Meperidine Injection	Analgesic	Hospira (50mg/mL vial)	Yes	alfentanil, sufentanil, remifentanil, fentanyl, dilaudid, hydromorphone, morphine	3/20/2012	6/3/2013
Methadone Hydrochloride Injection	Analgesic	Mylan (20 mL vial)	No	alfentanil, sufentanil, remifentanil, fentanyl, dilaudid, hydromorphone, morphine	12/4/2012	3/20/2013
Morphine Injections	Analgesic	APP (0.5mg/mL 2 mL ampule 10 count, 0.5mg/mL 10 mL vial 5 count, 0.5mg/mL 10 mL ampule, 1mg/mL 2mL ampule 10 count, 1mg/mL 10 mL vial, 1mg/mL 10 mL ampule), Hospira (0.5mg/mL 10 mL vial, 25mg/mL 4 mL vial, 50mg/mL 50 mL vial)	Yes	alfentanil, sufentanil, remifentanil, fentanyl, dilaudid, hydromorphone	1/6/2011	ongoing

Oxycodone Immediate Release Tablets and Capsules	Analgesic	Xanodyne (Roxicodone immediate-release tablets 5mg unit-dose tablets 100 count), Mallinckrodt (oxycodone immediate-release capsules 5mg 100 count), MidLothian Labs (oxycodone immediate-release capsules 5mg 100 count)	Yes	morphine, hydromorphone, hydrocodone, codeine	3/23/2011	6/25/2012
Sufentanil Injection	Analgesic	West-Ward (50mcg/mL 2 mL ampule), Hospira (50mcg/mL 1mL ampule, 1 mL Novaplus ampule, and 1 mL vial, 2mL ampule, 2 mL Novaplus ampule, and 2 mL vial, 5mL ampule, 5 mL Novaplus ampule, and 5 mL vial)	Yes	alfentanil, fentanyl, remifentanil, dilaudid, hydromorphone, morphine	11/9/2011	ongoing
Acyclovir Capsules and Tablets	Antiinfective	Ranbaxy (200mg capsules 500 count)	Yes	none	11/18/2009	7/16/2013
Acyclovir Sodium Injection	Antiinfective	Bedford (lyophilized powder for injection 500 mg vial and 1 g vial), APP (lyophilized powder for injection 500 mg vial, 50mg/ml solution for injection 10 mL vial and 20 ml vial)	No	none	11/13/2012	ongoing
Acyclovir Topical Cream and Ointment	Antiinfective	Valeant Pharmaceuticals (5% ointment 30g, 5% cream 2 g and 5 g)	Yes	none	8/7/2012	1/14/2013
Amikacin Injection	Antiinfective	Bedford (250mg/mL 2 mL vials package of 10, 250mg/mL 4 mL vials package of 10), Teva (250mg/mL 2 mL vials package of 10, 250mg/mL 4 mL vials package of 10)	No	gentamicin, tobramycin, streptomycin	7/6/2010	ongoing
Amphotericin B Cholesteryl Sulfate Lipid Complex Injection	Antiinfective	Alkopharma (lyophilized powder 50 mg vial and 100 mg vial)	Yes	none	2/15/2012	ongoing
Amphotericin B Injection	Antiinfective	X-Gen (50mg Novaplus vials)	Yes	none	10/4/2011	12/8/2011

Ampicillin Sulbactam	Antiinfective	Auromedics (3 g vial 10 count), Hospira (1.5 g and 3 g vial 10 count, 1.5 g and 3 g ADD-Vantage vial 10 count, 1.5 g and 3 g Novaplus ADD-Vanta vial 10 count, 15 g bulk vial 1 count), Mylan (1.5g and 3 g vial 10 count), Pfizer (1.5 g vial 10 count), Sagent (3 g vial 10 count and 15 g bulk vial 1 count), Sandoz (3 g vial 10 count and 15 g bulk vial 1 count)	Yes	piperacillin-tazobactam	6/24/2011	ongoing
Azithromycin Injection	Antiinfective	Apotex (500 mg vial package of 10), Pfizer (500 mg vial)	Yes	clarithromycin, erythromycin	1/2/2013	ongoing
Azithromycin Suspension	Antiinfective	Sandoz (100mg/5mL 15 mL bottle, 200mg/5mL 15 mL, 22.5 mL, and 30 mL bottles), Pfizer (2g/60mL adult and pediatric formulation bottles)	Yes	erythromycin, clarithromycin	10/13/2009	8/17/2010
Aztreonam Injection	Antiinfective	APP (1 g and 2 g vials)	Yes	none	1/23/2012	ongoing
Cefaclor Suspension	Antiinfective	Ranbaxy (cefaclor suspension)	Yes	cefuroxime	8/20/2009	5/15/2013
Cefazolin Injection	Antiinfective	Bbraun (1g/50mL premix, 2g/50mL premix), Apotex (1 g 10 count, 1 g 25 count, 10 g 1 count), Hospira (1 g 25 count, 10 g 10 count), Sandoz (10 g 10 count)	Yes	none	1/10/2013	ongoing
Cefotaxime Injection	Antiinfective	West-Ward (500 mg, 1g, and 2 g vials)	Yes	ceftazidime, ceftriaxone, cefepime	1/31/2013	ongoing
Cefotetan Disodium Injection	Antiinfective	Bbraun (cefotetan injection)	Yes	cefoxitin	3/12/2009	9/16/2011

Cefpodoxime	Antiinfective	Aurobindo (50mg/5mL 50 mL and 100 mL suspension), Ranbaxy (100 mg tablet 20 count, 200 mg tablet 20 and 100 count, 50mg/mL 50 mL and 100 mL suspension, 100mg/mL 50 mL and 100 mL suspension), Sandoz (50mg/5mL 50 mL and 100 mL suspension)	Yes	cefixime, cefdinir	3/20/2011	ongoing
Ceftazidime Injection	Antiinfective	Corvis (500 mg vials package of 10, 1 g vials package of 25), Sagent (1 g vials package of 25)	Yes	cefotaxime, ceftriaxone, cefepime	11/29/2011	ongoing
Cefuroxime Sodium Injection	Antiinfective	Covis (750 mg and 1.5 g vials package of 10, 750mg/50mL premix package of 24), Sagent (750 mg and 1.5 g vials package of 25, 7.5 g bulk vial package of 10), West-Ward (7.5 g bulk vial package of 10)	Yes	cefoxitin, cefotetan	1/25/2013	ongoing
Cephalexin Oral Suspension	Antiinfective	Orchid/Karalax (125mg/5mL 100 mL and 200 mL, 250mg/5mL 100 mL and 200 mL), Lupin (125mg/5mL 100 mL and 200 mL, 250mg/mL 100 mL and 200 mL), Ranbaxy (125mg/5mL 100 mL and 200 mL, 250 mg/5mL 100 mL and 200 mL), Teva (250mg/5mL 100 mL and 200 mL)	Yes	cefadroxil	7/19/2013	ongoing
Cidofovir Injection	Antiinfective	Gilead (75mg/mL 5mL vials), Heritage (75mg/5mL 5mL vials)	Yes	foscarnet, ganciclovir	2/15/2013	ongoing

Ciprofloxacin Immediate-Release Tablets	Antiinfective	Carlsbad Technologies (250 mg 100 and 1000 counts, 500 mg 100 and 500 counts, 750 mg 100 and 400 counts), Marlex (500 mg 100 count), Ranbaxy (250 mg 100 count, 500 mg 100 count, 750 mg 50 and 100 count), UDL (250 mg 100 count, 500 mg 100 count), West-Ward (500 mg 100 count)	Yes	levofloxacin	10/15/2009	ongoing
Ciprofloxacin Injection	Antiinfective	Claris (2mg/mL 200 mL premixed bag), Sagent (2mg/mL 100 mL and 200 mL premixed bag)	Yes	levofloxacin	6/3/2010	ongoing
Clarithromycin Immediate-Release Tablets	Antiinfective	Apotex (250 mg 60 count, 500 mg 60 count), Ranbaxy (250 mg 60 and 100 count, 500 mg 60 and 100 count), Abbott (250 mg 100 count), Mylan (250 mg 60 count, 500 mg 60 count), UDL (500 mg 100 count)	Yes	azithromycin, doxycycline	1/25/2011	ongoing
Clindamycin Injection	Antiinfective	APP (150mg/mL 2 mL vial), Hospira (150mg/mL 6 mL vial, 4mL ADD-Vantage vials, and 60 mL bulk vials), Sandoz (300mg/50mL, 600mg/50mL, and 900mg/50mL premix vials)	Yes	none	6/3/2013	ongoing
Dalfopristin/Quinupristin Injection	Antiinfective	Pfizer (500mg vials 10 count)	No	none	6/28/2013	8/1/2013

[Doxycycline Capsules and Tablets](#)

Antiinfective

Heritage (50 mg tablets 100 count), **Lannett** (100 mg tablets 50 and 250 counts), **Major** (50 mg capsules 50 count, 100 mg capsules 50, 100, and 500 counts, 100 mg tablets, 50, 100, and 500 counts), **Teva** (20 mg tablets 100 and 500 counts), **VersaPharm** (100 mg capsules 14 count), **Watson** (50 mg capsules 50 count, 100 mg capsules 50 and 500 counts), **West-Ward** (100 mg capsules, 20 count)

Yes

minocycline, tetracycline 4/9/2013

ongoing

[Doxycycline Hyclate Injection](#)
[Erythromycin Lactobionate Injection](#)

Antiinfective

Bedford (100mg vial)
Hospira (500 mg vials 10 count package, 500 mg Add-Vantage vials 10 count)

Yes

tigecycline 5/24/2010

8/21/2012

Antiinfective

azithromycin,
clarithromycin

9/3/2003

1/15/2013

Erythromycin Oral Products	Antiinfective	Abbott (Erythromycin stearate filmtab 250mg tablets 500 count, erythromycin base filmtab 250mg tablets 500 count, erythromycin delayed-release 250mg capsules 500 count, erythromycin delayed-release 250mg tablets 500 count and 333mg tablets 500 count, erythromycin ethylsuccinate 400mg Filmtab 100 count, 500 count, and 1000 count, erythromycin ethylsuccinate 200 Liquid 1 pint and 100 mL, erythromycin ethylsuccinate 400 liquid 1 pint and 100 mL, EryPed oral suspension 200mg/5mL 5 mL unit dose 100 count, EryPed oral suspension 200mg/5mL 200 mL, EryPed for oral suspension 400mg/5mL 5 mL unit dose 100 count, EryPed for oral suspension 400mg/5mL 60 mL and 200 mL, EryPed Drops for oral suspension 100mg/2.5mL 50 mL)	Yes	azithromycin, clarithromycin	3/11/2011	4/1/2011
Fluconazole Injection	Antiinfective	Bedford (2mg/mL 100 mL and 200 mL vials, 2mg/mL 200 mL premixed bag), Teva (2mg/mL 100 mL and 200 mL vials, 2mg/mL 100 mL and 200 mL premixed bags)	Yes	itraconazole, voriconazole, posaconazole	6/1/2010	ongoing
Foscarnet Injection	Antiinfective	Hospira (24mg/mL 250 mL and 500 mL packages of 12	No	Ganciclovir, Cidovovir	7/15/2010	2/27/2013

Gentamicin injection	Antiinfective	Baxter (1mg/mL 100mg/100mL premixed bags), Hospira (1.2mg/mL 60mg/50mL premixed bags, 1.6mg/mL 80mg/50mL premixed bags, 0.8mg/mL 80mg/100mL premixed bags, 1mg/mL 100mg/100mL premixed bags)	Yes	amikacin, tobramycin	5/17/2011	ongoing
Isoniazid Injection	Antiinfective	Sandoz (Nydravid injection)	No	none	1/29/2009	8/11/2010
Ivermectin Tablets	Antiinfective	Merck (Stromectol 3 mg tablets)	No	none	12/17/2010	12/22/2010
Levofloxacin Injection	Antiinfective	Sandoz (levofloxacin injection), Janssen (Levaquin vials)	Yes	ciprofloxacin, moxifloxacin	7/26/2011	10/12/2012
Meropenem Injection	Antiinfective	APP (meropenem injection)	Yes	doripenem, ertapenem, imipenem	10/24/2012	6/19/2013
Metronidazole Injection	Antiinfective	Claris (500mg/100mL 24 count), Hospira (500mg/100mL 80 count)	Yes	oral metronidazole	6/1/2010	ongoing
Metronidazole tablets and capsules	Antiinfective	Major (250mg 100 count), Watson (250mg 100 count, 500mg 50 count)	Yes	none	1/14/2011	2/15/2012
Nafcillin Sodium Injection	Antiinfective	Sandoz (1g vials)	Yes	oxacillin	11/12/2010	5/5/2011
Oseltamivir Phosphate Oral Suspension	Antiinfective	Genentech (6mg/mL 60 mL bottles)	Yes	zanamivir	1/11/2013	ongoing
Penicillin G Sodium Injection	Antiinfective	Sandoz (5 million unit vials)	Yes	none	6/1/2011	6/29/2011
Pentamidine Isethionate	Antiinfective	APP (Pentam300 for injection 300 mg 15 mL vial, NebuPent for inhalation 300 mg 15 mL vial)	No	none	8/31/2011	1/9/2013
Polymyxin B Sulfate Injection	Antiinfective	APP (500,000 units per vial 10 count), Beford (500,000 units per vial 10 count), Sagent (500,000 units per vial 10 count), X-Gen (500,000 units per vial 1 count)	Yes	colistin	11/15/2012	ongoing
Posaconazole Oral Suspension	Antiinfective	Merck (Noxafil oral suspension)	No	voriconazole, itraconazole, fluconazole	11/4/2010	2/1/2011

Primaquine Phosphate	Antiinfective	Sanofi-Aventis (26.3mg tablets 100 count)	No	none	8/19/2011	3/7/2012
Rifampin and Isoniazid Capsules	Antiinfective	Sanofi-Aventis (Rifamate capsules rifampin 300mg/isoniazid 150mg 60 count)	No	Yes	3/22/2013	7/16/2013
Rifampin for Injection	Antiinfective	Akorn (600 mg lyophilized vial), Bedford (600 mg lyophilized vial), Pfizer (600 mg lyophilized vial, 600 mg Novaplus lyophilized vial)	Yes	none	3/22/2013	ongoing
Streptomycin Injection	Antiinfective	X-Gen (1g vial 10 count)	No	gentamicin, tobramycin, amikacin	9/13/2011	11/8/2011
Sulfamethoxazole/Trimethoprim Injection	Antiinfective	Teva (sulfamethoxazole 80mg/trimethoprim 16 mg/mL 5 mL vial)	Yes	none	5/10/2010	ongoing
Tetracycline Capsules	Antiinfective	Teva (250 mg 100 count, 100 count unit dose, and 1000 count, 500 mg 100 count, 100 count unit dose, and 1000 count unit dose), Watson (250 mg 100 count and 1000 count, 500 mg 100 count and 1000 count)	Yes	doxycycline, minocycline	8/11/2011	ongoing
Ticarcillin Clavulanate	Antiinfective	GlaxoSmithKline (3.1 g ADD-Vantage vial and 3.1 g vial)	Yes	piperacillin	6/6/2011	ongoing
Tobramycin Injection	Antiinfective	APP (40mg/mL 30 mL vial), Hospira (10mg/mL 2 mL vial, 40mg/mL 2 mL and 50 mL vials, 80mg/100mL premixed bags), Teva (40mg/mL 2 mL and 30 mL vial)	Yes	gentamicin, amikacin	6/14/2011	ongoing
Vancomycin Hydrochloride Injection	Antiinfective	APP (5 g and 10 g vials), Hospira (5 g and 10 g vials, 500 mg Add-Vantage vials), Mylan (500 mg and 1 g vials)	Yes	daptomycin, linezolid	8/13/2013	ongoing

Voriconazole Tablets	Antiinfective	Greenstone (50mg and 200 mg 30 count), Sandoz (50mg and 200mg 30 count)	Yes	fluconazole, itraconazole, posaconazole	12/6/2012	4/19/2013
Dexamethasone Sodium Phosphate	Antiinflammatory	American Regent (4mg/mL 1 mL single dose vial, 5 mL and 30 mL multiple dose vials), Pfizer (4 mg/mL 1 mL and 5 mL vials)	Yes	methylprednisolone, hydrocortisone	1/15/2013	ongoing
Hydrocortisone Sodium Succinate Injection	Antiinflammatory	Hospira (100 mg vial)	Yes	dexamethasone, methylprednisolone	5/24/2012	ongoing
Methylprednisolone Acetate Injection	Antiinflammatory	Sandoz (40mg/mL 1 mL and 10 mL vials, 40mg/mL 1 mL vials package of 10, 80mg/mL 1 mL and 5 mL vials, 80mg/mL 1mL vials package of 10), Teva (40mg/mL 1 mL vials, 40mg/mL 1 mL vials package of 25)	Yes	dexamethasone, hydrocortisone	5/22/2012	ongoing
Methylprednisolone Sodium Succinate Injection	Antiinflammatory	APP (40 mg and 1 g single dose vials)	Yes	dexamethasone, hydrocortisone	5/13/2013	ongoing

Prednisone Tablets	Antiinflammatory	Cadista (1mg tablets 100 count and 1000 count, 5mg tablets 100 count and 1000 count, 10mg tablets 100 count and 1000 count, 20mg tablets 100 count and 500 count), Roxane (10mg tablets 100 count and 500 count, 20mg tablets 100 count and 500 count), Qualitest (1mg tablets 100 count and 1000 count, 2.5mg tablets 100 count, 5mg tablets 21 count, 48 count, 100 count, and 1000 count, 10mg tablets 21 count, 48 count, 100 count, 1000 count, 20mg tablets 100 count, 500 count, and 1000 count), Watson (5mg tablets 100 count and 1000 count, 10mg tablets 100 count, 500 count, and 1000 count, 20mg tablets 100 count, 500 count, and 1000 count), West-Ward (2.5mg tablets 100 count, 5mg tablets 100 count and 1000 count, 10mg tablets 100 count and 1000 count, 20mg tablets 100 count, 500 count, and 1000 count)	Yes	hydrocortisone, dexamethasone	6/14/2012	ongoing
Adenosine Injection	Cardiovascular	Bedford (3mg/mL 2 mL vial 10 count and 4 mL vial 1 count), Sagent (3mg/mL 2 mL prefilled syringe 10 count, 4 mL prefilled syringe 10 count, 4 mL vial 10 count) West-Ward (3mg/mL 2 mL vial 10 count), Wockhardt (3mg/mL 4 mL vial 10 count)	Yes	none	11/19/2012	ongoing
Amiodarone Hydrochloride Injection	Cardiovascular	APP (50mg/mL injection 3 mL vials package of 10), Hospira (50mg/mL injection 3 mL ampules package of 10)	Yes	none	1/21/2011	ongoing

Atropine Sulfate Injection	Cardiovascular	Hospira (0.05 mg/mL 5 mL Ansyrr syringe package of 10, 0.1 mg/mL 10 mL Ansyrr syringe package of 10, 0.1 mg/mL Lifeshield 21 gauge syringe package of 10, 0.1 mg/mL 5 mL Lifeshield syringe package of 10), American Regent (0.4 mg/mL 1mL single-dose vial package of 25, 1 mg/mL 1mL single-dose vial package of 25), Amphastar (0.1 mg/mL 10 mL Luer-Jet syringes)	Yes	none	8/2/2011	ongoing
Clevipidine Butyrate Injection	Cardiovascular	Medicines Company (0.5mg/mL 50 mL and 100 mL vials)	No	nicardipine	3/18/2010	1/4/2012
Digoxin Injection	Cardiovascular	GlaxoSmithKline (0.25mg/mL injection 2mL ampule 10 count and 50 count, 0.1mg/mL 1 mL ampule 10 count)	Yes	none	3/17/2011	4/19/2012
Diltiazem Injection	Cardiovascular	Bedford (5mg/mL 5 mL, 10 mL, and 25 mL vials)	Yes	verapamil	2/16/2012	ongoing
Dobutamine Injection	Cardiovascular	Baxter (100mg/250mL premix, 250mg/250mL premix, 500mg/250mL premix), Bedford (12.5mg/mL 20 mL vial), Hospira (12.5mg/mL 20 mL and 40 mL latex-free vials, 12.5mg/mL 20 mL vial 1 and 10 count, 12.5mg/mL 20 mL Novaplus vial, 1000mg/250mL premix)	Yes	none	6/22/2012	ongoing

Dopamine Injection	Cardiovascular	American Regent (40mg/mL 5 mL vial, 80mg/mL 5 mL vial, 160mg/mL 5mL vial), Bbraun (5% injection in Dextrose 400mg/250mL), Hospira (5% injection in Detrose 200mg/250mL, 400mg/500mL, 400mg/250mL, 800mg/250mL, 800mg/500mL; 40mg/mL 5 mL and 10mL vials)	Yes	none	3/21/2011	ongoing
Enalaprilat Injection	Cardiovascular	Bedford (1.25mg/mL 1 mL and 2 mL vials)	Yes	none	3/6/2012	ongoing
Epinephrine 0.1 mg/mL Emergency Syringes	Cardiovascular	Hospira (0.1mg/mL emergency syringes), Amphastar (0.1mg/mL emergency syringes)	Yes	none	5/28/2010	12/6/2010
Epinephrine Injection	Cardiovascular	American Regent (1mg/mL 1mL ampule package of 25, 1mg/mL 30mL multidose vial package of 5), Amphastar (0.1mg/mL 10mL syringe package of 10, 1mg/mL 30 mL vial), Hospira (0.1 mg/mL 10 mL Lifeshield 18 gauge and 21 gauge glass syringes packages of 10)	Yes	none	5/3/2011	ongoing
Esmolol Injection	Cardiovascular	Bedford (10mg/mL 10 mL single-dose vial package of 10)	Yes	metoprolol	9/21/2011	ongoing
Hydralazine Injection	Cardiovascular	American Regent (20mg/mL 1 mL vial)	Yes	none	4/20/2011	11/30/2011
Labetalol Injection	Cardiovascular	Bedford (5mg/mL 20 mL and 40 mL vials), Sagent (5mg/mL 20 mL vials)	Yes	propranolol	1/21/2011	ongoing
Lidocaine 2% Emergency Syringes	Cardiovascular	Hospira (2% emergency syringes)	Yes	none	8/13/2010	11/16/2011
Metoprolol Injection	Cardiovascular	American Regent (1mg/mL 5mL vial 25 count), Bedford (1mg/mL 5 mL vial 10 count), Hospira (1mg/mL 5mL vial)	Yes	atenolol, esmolol, labetalol, propranolol	1/10/2008	ongoing

Milrinone Injection	Cardiovascular	APP (1mg/mL 20 mL and 50 mL vials), Bedford (1mg/mL 10 mL, 20 mL, and 50 mL vials, 0.2mg/mL 100 mL and 200 mL premixed bags), Hospira (0.2mg/mL 100 mL and 200 mL premixed bags), West-Ward (1mg/mL 50 mL vial, 0.2mg/mL 100 mL premixed bag)	Yes	none	3/7/2011	ongoing
Nicardipine Hydrochloride Injection	Cardiovascular	Caraco (2.5mg/mL 10 mL ampules), Teva (2.5mg/mL 10 mL vials), Sandoz (2.5mg/mL 10 mL vials), American Regent (2.5mg/mL 10 mL vials), West-Ward (2.5mg/mL 10 mL vials), Cornerstone Therapeutics (2.5mg/mL 10 mL ampules), Wockhardt (2.5mg/mL 10 mL vials)	Yes	clevidipine	10/17/2008	ongoing
Nitroglycerin Injection	Cardiovascular	American Regent (5mg/mL 10 mL vials package of 25), Hospira (10mg/100mL in Dextrose 5% 250 mL glass bottles, 10mg/100mL in Dextrose 5% 500 mL glass bottles, 20mg/100mL in Dextrose 5% 250 mL glass bottles, 40mg/100mL in Dextrose 5% 250 mL glass bottles)	Yes	None	6/28/2012	ongoing
Norepinephrine Injection	Cardiovascular	Bedford (1mg/mL 4 mL vial package of 10), Hospira (1mg/mL 4 mL vial package of 10), Teva (1mg/mL 4 mL vial package of 10)	Yes	None	3/2/2011	ongoing
Phenylephrine Hydrochloride Injection	Cardiovascular	American Regent (10mg/mL 1 mL and 5 mL vials)	Yes	None	2/11/2013	ongoing
Procainamide Hydrochloride Injection	Cardiovascular	Hospira (500mg/mL 2 mL vials, 100mg/mL 10 mL vials)	No	quinidine	11/28/2011	ongoing

Sotalol Hydrochloride	Cardiovascular	Apotex (80 mg, 120 mg, 160 mg, and 240 mg packages of 100), Global Pharmaceuticals (80mg, 120mg, 160mg packages of 100), Upsher-Smith (80mg, 120mg, 160mg, 240mg packages of 100), Par (80mg packages of 100 and 1000, 120mg packages of 100 and 1000, 160mg package of 100)	Yes	amiodarone, dronedarone, dofetilide	1/29/2010	9/2/2010
Vasopressin Injection	Cardiovascular	American Regent (0.5 mL multidose vial 25 count, 1 mL multidose vial, 10 mL multidose vial)	Yes	none	5/19/2011	ongoing
Verapamil Injection	Cardiovascular	Hospira (2.5mg/mL 2 mL ampule, 4 mL Ansyr syringe, and 4 mL vial)	Yes	diltiazem	12/12/2012	ongoing
Alteplase Recombinant	Coagulation	Genentech (lyophilized powder 2mg vial 1 count)	Yes	reteplase, tenecteplase	2/27/2013	ongoing
Aminocaproic Acid Injection	Coagulation	American Regent (250mg/mL 20 mL vial), Hospira (250mg/mL 20 mL vial)	No	tranexamic acid	3/20/2013	ongoing
Argatroban Injection	Coagulation	Medicines Company (1mg/mL 50 mL vials 1 count)	Yes	none	12/1/2011	6/21/2012
Enoxaparin Injection	Coagulation	Sanofi-Aventis (30mg/0.3mL, 40mg/0.4mL)	Yes	dalteparin	1/20/2011	3/16/2011

Heparin Sodium Injection	Coagulation	APP (1000unit/mL 1 mL multidosed vial, 10000unit/mL 1 mL multidose vial), West-Ward (1000unit/mL 2 mL vial, 1000unit/mL 30 mL vial, 5000unit/mL 2mL vial, 5000unit/mL 10 mL vial, 10000unit/mL 2 mL vial), Hospira (1000unit/mL 1 mL single dose glass vial, 1000unit/mL 10 mL and 30 mL multidose glass vials, 5000unit/mL 1mL glass vial, 10000unit/mL 0.5 mL Carpuject package of 50, 10000unit/mL 1 mL glass vial, 10000unit/mL 0.5 mL Carpuject Luer Lock Slim-Pak package of 10, 10000unit/mL iSecure syringe package of 10, Sagent (10000unit/mL 4 mL vial)	Yes	enoxaparin, dalteparin	7/5/2012	ongoing
Phytonadione (Vitamin K) Injection	Coagulation	Amphastar (1mg/0.5mL SAF-T-JET prefilled syringe)	Yes	none	10/26/2011	6/11/2013
Protamine Sulfate	Coagulation	APP (10mg/mL 5 mL and 25 mL vials, 10mg/mL 5 mL and 25 mL Novaplus vials)	No	none	4/22/2011	3/8/2013
Retepase Injection	Coagulation	Cornerstone Therapeutics (one 10.4 unit single use vial, two 10.4 unit single use vials)	No	alteplase, tenecteplase	10/9/2009	ongoing
Warfarin Sodium Tablets	Coagulation	Bristol Myers Squibb (Coumadin 1mg, 2mg, 2.5mg, 3mg, 4mg, 5mg, 6mg, 7.5mg, 10mg tablets)	Yes	none	4/20/2012	12/6/2012
Acetazolamide Injection	Diuretic	Bedford (500 mg vial)	Yes	none	8/17/2010	ongoing
Furosemide Injection	Diuretic	Hospira (10mg/mL 4 mL syringe), American Regent (10mg/mL 2 mL, 4 mL, and 10 mL vials), APP (10mg/mL 2 mL, 4 mL, and 10 mL vials)	Yes	bumetanide, torsemide, ethacrynic acid	6/20/2012	ongoing

Mannitol Injection	Diuretic	American Regent (250mg/mL 50 mL vial 25 count), APP (250mg/mL 50 mL vial 25 count), Hospira (250mg/mL 50 mL vial 25 count)	Yes	none	11/15/2011	ongoing
Torsemide Injection	Diuretic	American Regent (10mg/mL 2 mL and 5 mL vials)	No	furosemide, bumetanide, ethacrynic acid	3/29/2012	ongoing
Famotidine Injection	GI	Bedford (10mg/mL 2 mL, 4 mL, 20 mL, and 50 mL vials), West-Ward (20 mL vial)	Yes	ranitidine	8/15/2011	ongoing
Octreotide Injection	GI	Bedford (50mcg/mL 1 mL vial, 100mcg/mL 1 mL vial, 500mg/mL 1 mL vial), Sandoz (200mcg/mL 5 mL vial, 1000mcg/mL 5 mL vial), Teva (50mcg/mL 1 mL vial, 100 mcg/mL 1 mL vial, 500mcg/mL 1 mL vial, 200mcg/mL 5mL vial, 1000mcg/mL 5 mL vial)	Yes	None	6/6/2011	ongoing
Pantoprazole Injection	GI	Pfizer (Protonix injection 40mg vial)	Yes	esomeprazole	2/15/2012	7/26/2012
Ranitidine Injection	GI	Bedford (25mg/mL 2 mL, 6 mL, and 40 mL vials), Covis (1mg/mL 50 mL premixed bag), GlaxoSmithKline (25mg/mL 2 mL, 6 mL, and 40 mL vials)	Yes	famotidine	8/17/2011	ongoing
Fosphenytoin Injection	Neurologic	Hospira (75mg/mL 2 mL vial 25 count, 75mg/mL 10 mL vial 10 count), West-Ward (75mg/mL 2 mL and 10 mL vials)	Yes	phenytoin	5/28/2010	ongoing
Levetiracetam Injection	Neurologic	UCB (100mg/mL injection)	Yes	none	2/26/2010	7/19/2010
Neostigmine Methylsulfate Injection	Neurologic	American Regent (0.5mg/mL 10 mL vial)	Yes	edrophonium, pyridostigmine	3/2/2011	ongoing
Phenytoin Injection	Neurologic	Hospira (50mg/mL 2 mL Carpuject syringe and 5 mL ampule)	Yes	fosphenytoin	3/3/2011	ongoing
Pyridostigmine Bromide Injection	Neurologic	Sandoz (5mg/mL 2 mL ampules)	No	edrophonium, neostigmine	3/2/2011	5/31/2013

Valproate Sodium Injection	Neurologic	Bedford (100mg/mL 5 mL vials)	Yes	none	4/14/2011	ongoing
Amino Acid Products	Nutrition/Electrolyte	Baxter (Travason 10% 1000 mL, Prosol 20% 2000 mL sulfite-free), Bbraun (Amino acid 15% solution 1000 mL, FreAmine III 10% 1000 mL, HeparAmine 8% 500 mL, NephroAmine 5.4% 250 mL, ProcalAmine 1000 mL), Hospira (Aminosyn 8.5% with electrolytes 500 mL sulfite-free, Aminosyn II 8.5% with electrolytes 500 mL sulfite-free)	Yes	none	9/9/2013	ongoing
Amino Acid Products with Electrolytes in Dextrose with Calcium (Clinimix E)	Nutrition/Electrolyte	Baxter (Clinimix E)	Yes	none	5/10/2013	ongoing
Calcium Chloride Injection	Nutrition/Electrolyte	American Regent (100mg/mL 10 mL vial), Calcium Chloride (100mg/mL 10 mL LifeShield syringe and 10 mL Ansyr syringe)	Yes	calcium gluconate	4/29/2011	ongoing
Calcium Gluconate Injection	Nutrition/Electrolyte	American Regent (100mg/mL 50 mL and 100 mL vials), APP (100mg/mL 10 mL, 50 mL, and 100 mL vials)	No	calcium chloride	11/9/2012	ongoing
Intravenous Fat Emulsion	Nutrition/Electrolyte	Hospira (10% 250 mL and 500 mL, 20% 250 mL and 500 mL, 30% 500 mL), Baxter (20% 100 mL, 250 mL, 500 mL, and 1000 mL, 30% 500 mL)	No	none	10/26/2009	ongoing

Magnesium Sulfate Injection	Nutrition/Electrolyte	American Regent (500mg/mL 2 mL, 10 mL, and 50 mL vials), APP (500mg/mL 2 mL, 10 mL, 20 mL, and 50 mL vials), Hospira (10mg/mL 100 mL premixed bag, 40mg/mL 50 mL, 100 mL, 500 mL, and 1000 mL premixed bags, 80mg/mL 50 mL premixed bag, 500mg/mL 10 mL syringe and 20 mL vial)	No	none	12/7/2011	ongoing
Potassium Chloride Injection	Nutrition/Electrolyte	APP (2mEq/mL 30mEq/15mL vials package of 25), Baxter (10mEq/1000mL in 5% dextrose, 20mEq/1000mL in 5% dextrose and 0.9% sodium chloride, 20mEq/1000 mL in 0.9% sodium chloride, 20mEq/1000mL in 5% dextrose and 0.45% sodium chloride, 20mEq/1000mL in 0.45% sodium chloride)	Yes	potassium acetate	2/28/2012	ongoing
Diphenhydramine Hydrochloride for Injection	Other	Hospira (50mg/mL)	Yes	none	10/5/2011	3/11/2013
Glucagon Injection	Other	Bedford (GlucaGen injection, GlucaGen diagnostic kit)	Yes	none	8/10/2010	3/14/2011
Glycopyrrolate Injection	Other	American Regent (0.2mg/mL 1 mL, 2 mL, 5 mL, and 20 mL vials), West-Ward (0.2mg/mL 1 mL, 2 mL, 5 mL, and 20 mL vials)	No	atropine	2/7/2011	ongoing
Naloxone Injection	Other	Hospira (0.4mg/mL)	Yes	none	9/2/2011	7/29/2013

Ondansetron Injection	Other	Baxter (32mg/50mL premixed bags), Bedford (2mg/mL 20 mL vial, 32mg/50mL premixed bags), Claris (32mg/50mL premixed bags), Hospira (2mg/mL 20 mL vial, 32mg/50mL premixed bags), Pfizer (2mg/mL 2 mL vials package of 25), Teva (2mg/mL 20 mL vials and 20 mL vials packages of 10, 32mg/50mL premixed bags), Wockhardt (2mg/mL 2 mL vials packages of 5, 20 mL vials)	Yes	granisetron	1/21/2011	ongoing
Prochlorperazine Edisylate Injection	Other	Bedford (5mg/mL 10 mL vial)	Yes	promethazine	9/22/2011	5/3/2013
Atracurium Injection	Paralytic	Bedford (5 mL single dose vial and 10 mL multi-dose vial)	Yes	cisatracurium, pancuronium, rocuronium, succinylcholine, vecuronium	2/27/2012	ongoing
Pancuronium Injection	Paralytic	Hospira (1mg/mL 10 mL vial package of 25)	No	atracurium, cisatracurium, pancuronium, rocuronium, succinylcholine	5/7/2010	ongoing
Rocuronium Injection	Paralytic	APP (10mg/mL 10 mL vials package of 10), Hospira (10mg/mL 5 mL vials package of 10, 10mg/mL 10 mL vials package of 10), Sandoz (10mg/mL 5 mL vials package of 10), Teva (10mg/mL 5 mL and 10 mL vials packages of 10), Merck (10mg/mL 10 mL package of 10)	Yes	atracurium, cisatracurium, pancuronium, succinylcholine, vecuronium	9/3/2013	ongoing
Succinylcholine chloride Injection	Paralytic	Hospira (10mg/mL 10 mL vial)	Yes	atracurium, cisatracurium, pancuronium, rocuronium, vecuronium	8/12/2013	ongoing

Vecuronium Bromide Injection	Paralytic	Bedford (10 mg and 20 mg vials packages of 10), Hospira (10 mg vials package of 10), Teva (10 mg and 20 mg vials packages of 10), Sagent (10 mg vials)	Yes	atracurium, cisatracurium, pancuronium, rocuronium, succinylcholine	8/8/2013	ongoing
Diazepam Injection	Sedative	Hospira (5mg/mL 2 mL Carpuject Luer-Lock syringes package of 10 and 10 mL vials package of 10)	Yes	lorazepam, midazolam	12/22/2011	ongoing
Droperidol Injection	Sedative	American Regent (2.5mg/mL 2 mL vials), Hospira (2.5mg/mL 2 mL ampule)	No	none	8/15/2011	ongoing
etomidate Injection	Sedative	American Regent (2mg/mL 10 mL and 20 mL vials), Bedford (2mg/mL 10 mL and 20 mL vials), Mylan (2mg/mL 20 mL vial)	Yes	none	7/6/2011	ongoing
Ketamine Injection	Sedative	Bedford (50mg/mL 10 mL vial package of 10)	Yes	none	1/31/2012	ongoing
Lorazepam injectable presentations	Sedative	Hospira (2mg/mL 10 mL vial, 4mg/mL 1 mL and 10 mL vials, 4mg/mL 1mL Carpuject syringe), Ativan (4mg/mL 1 mL and 10 mL vials)	Yes	diazepam, midazolam	4/8/2011	ongoing

Midazolam Injections	Sedative	Akorn (1mg/mL 2mL vials 25 count, 1mg/mL 5 mL vials 10 count, 5mg/mL 1 mL vials 25 count), APP (1mg/mL 5 mL vials 25 count), Bedford (1mg/mL 2 mL and 5 mL vials 10 count, 1mg/mL 10 mL vials 10 count, 5mg/mL 1 mL, 2 mL, 5 mL, and 10 mL vials 10 count), Hospira (1mg/mL 5mL vials 10 count, 1mg/mL 10 mL vial, 5mg/mL 1mL vial, 5mg/mL 1mL Luer-Lock syringe 10 count, 5mg/mL 10 mL vial 10 count), Sagent (1mg/mL 10 mL vial), West-Ward (1mg/mL 2 mL vial 10 count, 1mg/mL 2 mL dosette vial, 1mg/mL 5 mL vial 10 count, 1mg/mL 2mL latex free vial 10 count)	Yes	diazepam, lorazepam	12/14/2011	ongoing
Propofol Injection	Sedative	APP (10mg/mL 20 mL, 50 mL, and 100 mL vial, 10mg/mL 50 mL and 100 mL Novaplus vial)	Yes	none	10/28/2009	ongoing

**Business and Continuity of Operations online appendix
Summary prepared November 2013**

Jeffrey R Dichter, MD, who was both a topic editor and executive committee member, prepared this summary.

The original 13 questions defined by the Business and Continuity of Operations Panel at the June 2012 meeting are listed below:

Business and Continuity of Operations- Summary of Key Questions

1. What are the implications of the fully globalized supply chain that the critical care practitioner must be aware of when planning for both their day-to-day continuity of operations as well as during a disaster.
 - a. This issue is really the “NEW” level of MASS casualty disaster eg/a global shortage of critical care supplies, global system failure due to global supply chain failure

2. How can health care coalitions or governments interface with private providers of essential supplies to strategically distribute scarce resources?
3. What consequences do the differential duration of a disaster's impact on critical care and surgical operations' (eg. as opposed to on emergency departments) have on the planning assumptions and preparations for continuity of operations in these areas?
4. How can academic medical centers and other large health systems be leveraged to support disaster response?
 - a. NC State SMAT program
 - b. Integration into system
5. What are the key business and continuity of operations considerations for systems and individual critical care providers responding to a disaster or suffering from a disaster.
6. What are the finance issues and potential management mechanisms that must be considered when your institution is struck by a disaster?
 - a. Credentialing surge staff with payer
 - b. Documentation necessary for billing
 - c. Cash flow issues for hospitals while awaiting reimbursement
 - d. Agreements with CMS/payer prior to event
 - e. Domestic vs Intl response & payment
 - f. Displaced uninsured persons into hospital catchment area
7. What the implications of an EHR based system on provision of mass critical care
 - a. Surge capacity
 - b. Unique identifiers (patient transfer/evac implications)
 - c. Infrastructure vulnerability
 - d. System Failure (paper backup process but sig bottlenecks)
 - e. Equipment data capture outside of the ICU
8. What special considerations are required regarding hospital/critical care unit relationships with vendors related to disaster preparedness/response?
 - a. Different facilities double counting surge supplies
 - b. Sole source supply chain issues
9. What questions must critical care systems ask of their key partners regarding their partners' disaster preparedness?
 - a. Eg. Plan is to off-load to long-term vent centre, these places seeing themselves as low acuity institutions may not have robust emerg prep plan therefore causing the ICU's plan to fail
10. What are the considerations for critical care health human resources in preparing for or responding to a disaster?
11. Staffing vulnerabilities (positions staffed only 1 or 2 deep)
 - a. Care of family members/pets etc
 - b. Retention of staff post disaster
 - c. This question may go better under Surge
12. Essential Services
 - a. Engineered failure
 - b. What will be provided vs what won't
 - c. Communication of both what isn't AND is being provided to the community

13. Stockpile issues

- a. Stockpile/inventory mgmt
- b. Coordination
- c. Deployment for non-local disasters (eg international)

Business and Continuity of Operations Panelists

Pritish Tosh
Henry Feldman
Michael Christian
Jeffrey Dichter
Martha Bartz
Bruce Cairns
Deborah Levy
Preston Rich
Babak Sarani
John Wilgis

Based on the above key questions, the Business and Continuity of Operations Panel was divided into 2 working groups, with focus on Medication and medical supply chain vulnerability, and information technology (IT) vulnerability in a disaster.

Medication and medical supply chain vulnerability

Initial literature searches were performed using the following search terms: shortages, medical supply chain, medications, drugs, and medical supplies.
Timeframe: 2008 to February 2013

145 articles were found, and reviewed by Dr. Tosh and Dr. Dichter. 109 articles were felt to be relevant and all were pulled and reviewed.

There were no articles found in these literature searches felt to provide significant high-grade data addressing the key questions.

Information Technology Vulnerability

Initial literature searches were performed using the following search Terms:

Disaster preparedness health information technology (HIT)
Disaster preparedness informatics
Disaster preparedness electronic health record (EHR)
Disaster management HIT
Disaster EHR
Mass casualty EHR
Mass casualty informatics

Timeframe: 2008 to March 2013

Dr. Feldman and Dr. Dichter reviewed literature searches, and 10 articles were pulled and reviewed. Unfortunately, these searches were not kept nor were the total number of articles reviewed recorded. Of note, these seven search terms were entered into PubMed in November 2013, and 370 articles were obtained, which is a reasonable estimate of the number of articles actually reviewed in March 2013.

There were no articles found in these literature searches felt to provide significant high-grade data addressing the key questions.

Addendum regarding suggestions 19-21, which were omitted from the final manuscript.

The following 3 suggestions (19-21) were passed by $\geq 80\%$ of the task force during the Delphi process first round. However, at the topic editors face-to-face Chicago meeting in April 2013 (between rounds 1 and 2), the Topic Editors felt that the Task Force felt did not have sufficient IT expertise to warrant these suggestions being included. It was decided at this meeting that they would be withdrawn as suggestions, but included in the manuscript's on-line supplemental material.

Original Delphi Suggestion 19: We suggest hospitals should have spare servers for a years worth of operations (these can be non-critical function servers that can be repurposed).

Original Delphi Suggestion 20: We suggest in an extended disaster (such as post-hurricane Katrina) plans need to be in place to continue computer support for patient care, finance, education, research operations, etc. from an IT standpoint, with sufficient storage and servers for anticipated growth.

Original Delphi Suggestions 21: We suggest hospitals and health systems inventory all computer systems that can be cannibalized in the setting of extreme shortage. Plans should be made for long-term relief of the effected systems in these non-critical areas to support long-term continuity.