Drug	First concentration	Commercially available	Second concentration	Commercially available	Third concentration	Commercially available	ISMP neonatal standards	Preferred dosing units	Concentration vs. unit mismatch	Comments on dosing units	Clinical considerations	Concentration considerations
Alprostadil	10 mcg/mL	no					10 mcg/mL	mcg/kg/min	Possibly depending on vial purchased			Some hospitals may have different concentrations for transplant protocols. The expert panel encourages using the 10 mcg/mL for all doses when possible. If a lower concentation is needed, the panel recommends 5 mcg/mL
Alteplase	1 mg/mL	yes						mg/kg/hour	no			
Amiodarone	1.8 mg/mL	yes	3.6 mg/mL	no				mcg/kg/min	yes	suggested weight cutoff for mg/min is at 50 kg		
Argatroban	1 mg/mL	yes						mcg/kg/min	yes			
Bumetanide	0.04 mg/mL	no	0.25 mg/mL	yes, undiluted drug from the vial				mg/kg/hour	no	mg/kg/hour - PCCM article using mcg/kg/hour	Recommend using furosemide as first line loop diuretic unless on shortage	Have a thoughtful discussion about mg vs. mcg based on your EHR and pump capabilities and decimal places
Cisatracurium	2 mg/mL	Yes, undiluted from the 2 mg/mL vial						mg/kg/hour	yes	differences - mg/kg/hour vs. mcg/kg/min	Caution: comes as 10 mg/mL as well - used in pharmacy for compounding	
Dexmedetomidine	4 mcg/mL	yes						mcg/kg/hour				
DOBUTamine	1000 mcg/mL	yes	2000 mcg/mL	yes	4000 mcg/mL	yes	2000 mcg/mL	mcg/kg/min	No; however if repackaging pharmacy label may create mismatch			for the lower concentration can just use drug from the 2000 mcg/mL bag and dilute 1:1 with diluent
DOPamine	800 mcg/mL	yes	1600 mcg/mL	yes	3200 mcg/mL	yes	1600 mcg/mL	mcg/kg/min	no, however if repackaging pharmacy label may create mismatch			for the lower concentration can just use drug from the 1600 mcg/mL bag and dilute 1:1 with diluent
EPINEPHrine	10 mcg/mL	no	20 mcg/mL		40 mcg/mL		10 mcg/mL	mcg/kg/min	possibly depending on pharmacy label	recommend using mcg/kg/min in patients 50 kg or above for consistency	If a 4th concentration is needed for higher dosing the panel recommends 100 mcg/mL	The expert panel and ISMP recommend different concentrations of epinephrine vs. norepinephrine given different indications despite same dosing units. This is also consistent with dopamine/ dobutamine
Esmolol	10 mg/mL	yes	20 mg/mL	yes				mcg/kg/min	yes			

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Fenta**NYL**	5 mcg/mL based on stability	no	10 mcg/mL	no	50 mcg/mL	yes, as undiluted from 50 mcg/mL vial	10 mcg/mL	mcg/kg/hour	possibly depending on pharmacy or oursourcing facility label	possibly; use mcg/hour for patients 50kg or above and/or obese patients		This needs repackaging by either the pharmacy, or may be purchased from outsourcing facility. Watch the display units on the label
Furosemide	0.4 mg/mL based on stability	no	2 mg/mL	no	10 mg/mL	yes, as undiluted from 10 mg/mL vial	2 and 10 mg/mL	mg/kg/hour	no	should transition to mg/hour in patients 50kg or above		
Heparin	50 units/mL	yes	100 units/mL	yes				units/kg/hour	no	Some protocols for patients 50kg or greater may call for units/hour		Pharmacies should only stock one size of the 50 units and 100 units/mL bag concentrations and reserve the 50 units/mL for patients 5 kg or below
HYDROmorphone	0.2 mg/mL	no, but many pharmacies purchase from outsourcing facilities	1 mg/mL	no, but many pharmacies purchase from outsourcing facilities				mcg/kg/hour	possibly depending on pharmacy label or oursourcing facility label	should transition to mg/hour for patients 50kg or above		Need to consider concentration/dosing changes when using different delivery pumps. In addition, PCA pumps often round when doses become very small. The 5 mg/mL should be restricted for patients 50kg or above.
Insulin (regular)	0.05 units/mL	no	0.2 units/mL	no	1 unit/mL		0.1 and 0.5 unit/mL	units/kg/hour	possibly depending on pharmacy label or oursourcing facility label	For non -DKA, non overdose treatment dosing, change to units/hour for patients 50kg or above	Dosing units suggested don't include DKA and OD treatment protocols	Some studies/protocols call for the addition of albumin for lower concentrations. The panel didn't adopt ISMP recommendations because of a 10-fold difference
Isoproterenol	4 mcg/mL	no	20 mcg/mL	no	64 mcg/mL			mcg/kg/min	possibly depending on pharmacy label or oursourcing facility label	dosing in patients 50 kg or above may be given in units/min	may be different based on heart transplant protocols.	concentrations provided are based on stability data so transplant protocols should match concentrations
Ketamine (high dose sedation/anesthesia)	10 mg/mL	yes, undiluted drug from the vial of 10 mg/mL						mg/kg/hour	possibly depending on pharmacy label or oursourcing facility label	*mcg/kg/min vs. mg/kg/hour		Use caution with vial availablity. There are 50 mg/mL and 100 mg/mL vials available for IM use or pharmacy compounding.

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Ketamine (acute pain)	10 mg/mL	yes, undiluted drug from the vial of 10 mg/mL						mg/kg/hour	possibly depending on pharmacy label or oursourcing facility label			Be careful with vial availablity. There are 50 mg/mL and 100 mg/mL vials available for IM use or pharmacy compounding
Labetalol	1 mg/mL	no	5 mg/mL	yes, undiluted drug from the vial of 5 mg/mL				mg/kg/hour	possibly depending on pharmacy label or oursourcing facility label	consider switching to mg/min for patients 50 kg or above		
Lidocaine (antiarrythimic)	8 mg/mL	yes						mcg/kg/min	yes, with commercially available product	consider switching to mg/min for patients 50 kg or above	Concentration recommended based on cardiac indications and not acute pain use	
LORazepam										mg/kg/hour or mcg/kg/hour	The expert panel does not recommend continuous infusions due to long half-life and the propylene glycol vehicle that can accumulate resulting in an osmolar gap and renal implications	If using, consider concentrations of 0.2 mg/mL or 1 mg/mL. Concentrations in between such as 0.5 mg/mL cause preceipitation
Midazolam	0.5 mg/mL based on stablility data	no	1 mg/mL	yes, undiluted drug from the vial of 1 mg/mL vial	5 mg/mL	yes, undiluted drug from the vial of 5 mg/mL vial	0.5 and 1 mg/mL	mg/kg/hour	yes, possibly based on pharmacy label and/or outsourcing company	mcg/kg/hour is alternative dosing units. Consider switching to mg/hour for patients 50kg or above		
Milrinone	200 mcg/mL	yes						mcg/kg/min	no			may need higher concentration for outpatients

Drug	First concentration	Commercially available	Second concentration	Commercially available	Third concentration	Commercially available	ISMP neonatal standards	Preferred dosing units	Concentration vs. unit mismatch	Comments on dosing units	Clinical considerations	Concentration considerations
Morphine	0.04 mg/mL	no	0.5 mg/mL	no	1 mg/mL	yes, undiluted drug from the vial of 1 mg/mL vial or ready-to-use products or premix products available	0.1 and 0.5 mg/mL	mg/kg/hour	possibly depending on pharmacy label or oursourcing facility label	mcg/kg/hour is alternative dosing units. Consider switching to mg/hour for patients 50 kg or above	need for PF morphine vs. not - the amount is really insignificant	
Naloxone	40 mcg/mL	no	400 mcg/mL	yes, 0.4 mg/mL vials, however will most likely compound from 1 mg/mL vials				mcg/kg/hour	yes		Multiple indications for naloxone so please differentiate in EHR and pumps	Lowest concentration studied for stability is 0.04 mg/mL. In addition the panel recognizes these two concentrations are 10x however those are the only concentrations studied for stability.
Ni**CAR**dipine	0.1 mg/mL	yes	0.5 mg/mL	no				mcg/kg/min	yes			
Nitroglycerin	200 mcg/mL	yes	400 mcg/mL	yes				mcg/kg/min	no, product does have concentration in mcg/mL	consider switching to mcg/min for patients 50 kg or above		
Nitroprusside	200 mcg/mL	yes	500 mcg/mL	yes				mcg/kg/min	possibly depending on pharmacy label or oursourcing facility label	mcg/kg/min also used for patients 50 kg or above		
Norepinephrine	16 mcg/mL	no	32 mcg/mL	no	128 mcg/mL	no	16 mcg/mL	mcg/kg/min	possibly depending on pharmacy label or oursourcing facility label	mcg/kg/min. Panel recommends adult dosing also be mcg/kg/min but may choose mcg/min		The 128 mcg/mL concentration may not need to be adopted given patient population
Octreotide	2.5 mcg/mL	no	10 mcg/mL	no	50 mcg/mL	no, but undiluted drug straight from the vial of 50 mcg/mL vial/ampule		mcg/kg/hour	possibly depending on pharmacy label or oursourcing facility label	mcg/kg/hour and consider switching to mcg/hour for patients 50 kg or above	2 indications: GI bleed, chylothorax	The pharmacy may stock higher concentrations for intravenous infusions or subcutaneous but do not stock in patient care areas

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Pantoprazole	0.8 mg/mL	no						mg/kg/hour	no	mg/kg/hour and consider switching to mg/hour for patients 50 kg or above		only one concentration from stability studies and package insert
PENTobartibal	8 mg/mL	no	50 mg/mL	yes, undiluted drug from the 50 mg/mL vial				mg/kg/hour	no		Also has propylene gycol as IV vehicle in addition to very pH basic drug	Stability studies are for 8 mg/mL or less, or for 50 mg/mL. Use only 0.9% NS for 8 mg/mL dilutions. The 50 mg/mL concentration is very basic; infusion with other drugs or carrier fluids will result in precipitation
Phenylephrine	80 mcg/mL	no	400 mcg/mL	no				mcg/kg/min	possibly depending on pharmacy label or oursourcing facility label	mcg/kg/min. Panel recommends adult dosing also be mcg/kg/min but may choose mcg/min		The 400 mcg/mL may not be needed given the patient poluplation treated
Propofol	10 mg/mL	yes						mcg/kg/min	yes	mcg/kg/min		
Remifentanil	50 mcg/mL (non-recon vial straight drug)	no	250 mcg/mL	no				mcg/kg/min	possibly depending on pharmacy label or oursourcing facility label		Consider restrictions to OR only	
Rocuronium	10 mg/mL	yes, undiluted drug from the vial of 10 mg/mL						mcg/kg/min	possibly depending on pharmacy label or oursourcing facility label		straight drug and consitent with OR	Based on weight of children receiving continuous rocuronium infusions the 10 mg/mL met the minimum calculations. If a lesser concentration is needed then consider 0.5-5 mg/mL.
Sodium Bicarbonate	0.5 mEq/mL	yes, undiluted if using the prefilled 0.5 mEq/mL syringes	1 mEq/mL	yes, as undiluted drug from the 1 mEq/mL vial				mEq/kg/hour	no			
Sodium Chloride	0.5 mEq/mL (3%)	yes, as 500 mL bags						mL/kg/hour vs. mEq/kg/hour, depending on institution protocols	yes, based on dosing units used		Used for hyponatremia and TBI protocols. Differentiate in EHRs and pumps accordingly	Some protocols may use 23.4% for bolus doses but do not recommend for continuous infusions. Recommended only pharmacy stock the 23.4% concentration and send bolus doses

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Tacrolimus	0.02 mg/mL	no						mg/kg/day	possibly depending on pharmacy label or oursourcing facility label	Some may use mL/kg/day	transplant protocols	
Terbutaline	1 mg/mL	yes, undiluted from the 1 mg/mL vial						mcg/kg/min	possibly depending on pharmacy label or oursourcing facility label			The drug is currently only commercially available as 1 mg/mL, 1 mL vials. Infusions take several minutes to compound given 25-50 vials must be used at a time
Tranexamic Acid	100 mg/mL (straight drug)	yes, undiluted from the 100 mg/mL vial						mg/kg/hour	no			Drug is frequently on shortage list
Vasopressin (vasopressor)	0.01 units/mL	no	0.05 units/mL	no	0.2 units/mL	no		milliunits/kg/min	possibly depending on pharmacy label or oursourcing facility label	Dosing units for vasopressin can be very complicated given the different indications. Use indication nomenclature in EHR and pumps to assure correct dosing units	If units/kg/min dosing is used then pumps/EHRs will need to accommodate 4 decimal points	If a higher concentration is needed then consider 1 unit/mL
Vasopressin (DI)	Institution specific	no						milliunits/kg/HOUR	possibly depending on pharmacy label or oursourcing facility label			
Vecuronium	1 mg/mL	no, but when the vial is diluted then no further dilution is needed						mcg/kg/min	possibly depending on pharmacy label or oursourcing facility label	mg/kg/hour may also be used		