Inclusion Criteria
- Suspected DKA OR
- Suspected new diabetes

Exclusion Criteria
- None

Suspected DKA or Diabetes
• Use ED DKA Suspected Plan to
  • Rule out DKA
  • Test for new diabetes

DKA confirmed?  
Yes → Treat per DKA Pathway
  • Use ED DKA Suspected Plan

No → Diabetes Diagnosis Confirmed?  
Yes → Treat Diabetes (Non-DKA)
  • Use ED Diabetes (Non-DKA) Plan
  • If hyperglycemia with ketosis (BOHB ≥ 0.6 mmol/L or MODERATE to LARGE urine ketones), in consultation with endocrinologist consider ordering one-time “insulin for sick day -)” dose, following Sick Day Management Pathway

No → Not Diabetes
**Establish New Diagnosis**

**Diet**
- Modified Diet Carbohydrate-counted (insulin dependent)

**Medications**
- Consider Total Daily Dose (TDD) insulin 0.3-1 units/kg/day, adjusted according to glucose, using
  - Basal insulin once or twice daily (40-50% TDD)
  - Rapid-acting insulin at each meal, snacks, bedtime, and 0300

**Routine Monitoring**
- Check glucose 1-2 hours after first subcutaneous insulin dose
- Check glucose at least every 3 hours 2100-0900 for first 24 hours
- Check glucose before meals, at bedtime, and 0300 AND
  - At least every 3 hours if NPO
  - At patient/family request
  - If signs of hypoglycemia (pallor, sweating, shaking, irritability, confusion, or seizures)
  - More frequently if vomiting/diarrhea, change in dextrose rate or concentration of IV fluids, change in feeds, or change in medication (steroids, etc)

**Discharge Criteria**
- Home insulin regimen determined
- Demonstrated ability to independently administer insulin, monitor glucose and determine intervention, and prevent, identify and treat hypoglycemia, hyperglycemia and ketonuria.
- Primary care provider and endocrinology follow-up arranged within 3 weeks of discharge
- Prescriptions for insulin, glucagon, and other supplies provided
- Teaching completed

**Treatment**

**HYPOglycemia Safety**
- Call provider for hypoglycemia: glucose < 60 mg/dL (For patients that cannot tolerate enteral intake or are NPO: glucose < 80 mg/dL)
- Follow Diabetes: (Non-DKA) Hypoglycemia Management for glucose < 80 mg/dL

**HYPERglycemia Safety**
- For glucose > 500 mg/dL x 1 or > 250 mg/dL x 2
  - Check BOHB or urine ketones
  - Call provider with glucose and ketone results to evaluate for DKA

**Diabetes Self-Management Education and Support**

**Consults**
- Endocrine (if not primary service)
- Nutrition
- Social work

**Discharge Appointment**
- Follow-up with Endocrinology 2-3 weeks after discharge

**Discharge Instructions**
- Call the diabetes nurses’ line to review blood glucose within 48 hours after discharge.
- Call the endocrinologist on call for urgent questions about blood glucose.
Diabetes Established Diagnosis (Non-DKA) v6.1

Inclusion Criteria
- Patient with established diagnosis of diabetes on subcutaneous insulin

Exclusion Criteria
- Diabetic ketoacidosis (DKA) (use instead DKA Pathway)
- New diabetes diagnosis requiring teaching for insulin use
- Continuous insulin infusion
- Intravenous insulin (for hyperkalemia, in TPN)
- Sliding scale insulin

Treatment

HYPOglycemia Safety
- Call provider for hypoglycemia: glucose < 60 mg/dL (For patients that cannot tolerate enteral intake or are NPO: glucose < 80 mg/dL)
- Follow Diabetes: (Non-DKA) Hypoglycemia Management for glucose < 80 mg/dL

HYPERglycemia Safety
- For glucose > 500 mg/dL x 1 or > 250 mg/dL x 2
- Check BOHB or urine ketones
- Call provider with glucose and ketone results to evaluate for DKA or Sick Day Management

Diet
- Modified Diet Carbohydrate-counted (insulin dependent)
- Consult
- Endocrine (if not primary service)

Insulin
- Basal insulin once or twice daily
- Rapid-acting insulin at each meal, snacks, bedtime, and 0300

Routine Monitoring
- HbA1c upon admission if not already done in past 2 months
- Check glucose before meals, at bedtime, and 0300 AND
  - At patient/family request
  - If signs of hypoglycemia (pallor, sweating, shaking, irritability, confusion, or seizures)
  - More frequently if vomiting/diarrhea, change in dextrose rate or concentration of IV fluids, change in feeds, or change in medication (steroids, etc)

Intensive Monitoring
- Check glucose
  - Postop hourly for 2 hours after arrival to acute care unit
  - At least every 3 hours if NPO

Insulin
- Basal insulin per home regimen
- Rapid-acting insulin
  - Inject after meals when eating
  - Order every 3 hours PRN other than meal/snack/bed/night doses

Fluids
- Use fixed rate (no IV + PO)
- Consider dextrose-containing fluids (D5½NS or D5NS)
- Alternatively for patients with stable glucose, consider dextrose-free fluids (½ NS)
- Newly post-op:
  - Consider D5NS to prevent hyponatremia
  - Avoid added potassium
  - Discontinue when oral intake is adequate

Discharge Criteria
- Primary care provider and endocrinology follow-up arranged within 3 months

Discharge Instructions
- Call diabetes nurses’ line to review blood glucoses within 48 hours after discharge.
- Call the endocrinologist on call for urgent questions about blood glucose.

Unreliable Oral Intake or NPO (e.g., Post-op, Young Age, Vomiting)
- Initiate Orders
- Discontinue Orders

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Anesthesia/PACU Perioperative Diabetes (Non-DKA): Discharge to Home v6.1

Inclusion Criteria
- Patients with diabetes mellitus type 1 or 2 requiring a surgical procedure
- Treated in PACU to be discharged home

Exclusion Criteria
- Admitted to hospital (use other page)
- DKA (use DKA Pathway)

Discharge Criteria
- Patient is ready to resume home insulin
- Patient is able to tolerate oral intake

Orders
- Anesthesiologist has ordered PACU insulin and diabetes management using Anesthesia Diabetes (Insulin) Perioperative Plan
- Advance diet as tolerated per home dietary restrictions (if requested for extended stay, order carb-counted meal)
- Consult endocrinologist for complex transition plans

Routine Monitoring
- Check BG upon arrival to PACU then every 30 minutes until child wakes from anesthesia, then hourly until discharge to home

PACU Phase 1 and 2

HYPOglycemia Safety
- For glucose < 80 mg/dL, call provider and follow Diabetes: (Non-DKA) Hypoglycemia Management

HYPERglycemia Safety
- For glucose > 250 mg/dL
  - Notify anesthesia provider
  - Check BOHB
  - If BOHB ≥0.6 mmol/L, consult endocrine

Basal-Bolus Insulin
- Order one time insulin dose based on home regimen.
- Correct BG with rapid-acting insulin if it has been at least 3 hours since last rapid-acting dose

Insulin Pump

Patients arriving in PACU on insulin pump, or restarted:
- Patient/family verifies that insulin pump is infusing
- Until caregiver is managing insulin pump, order one time subcutaneous insulin dose.
- If BG >250 mg/dL and it has been at least 3 hours since last rapid-acting dose, correct with rapid-acting insulin
- Instruct patient/caregiver when to resume home routine insulin (change target insulin back to usual home setting)

Discharge Instructions
- Confirm with caregiver that insulin pump settings are accurate per home regimen
- Pamphlet Surgery and Diabetes (PE1855)
- Pamphlet Sick Day Management (PE288)
- Advance diet as tolerated per home dietary restrictions
- Call the diabetes nurses’ line or managing endocrine provider to review blood glucoses within 48 hours after discharge.
- Call the endocrinologist on call or managing endocrine provider for urgent questions about blood glucose.

Glossary
BG: blood glucose
Basal insulin: long acting subcutaneous insulin given 1-2 times a day to provide a steady dose of insulin throughout the day
Bolus insulin: rapid-acting subcutaneous insulin used to treat blood glucose above target or to cover carbohydrates in food
BOHB: beta hydroxybutyrate, used to measure ketones

Glossary, Cont
Continuous IV insulin infusion: an insulin drip made by hospital pharmacy and administered via a hospital pump
Home insulin pump: provides a continuous subcutaneous infusion of insulin and bolus doses of insulin as programmed. Competent caregiver required for perioperative management.
Glossary
BG: blood glucose
Basal insulin: long-acting subcutaneous insulin given 1-2 times a day to provide a steady dose of insulin throughout the day
Bolus insulin: rapid-acting subcutaneous insulin used to treat blood glucose above target or to cover carbohydrates in food
BOHB: beta-hydroxybutyrate, used to measure ketones

Inclusion Criteria
• Patients with diabetes mellitus type 1 or 2 requiring a surgical procedure
• Treated in PACU to be admitted to hospital

Exclusion Criteria
• Discharged to home (use other page)
• DKA (use DKA Pathway)

Orders
• Anesthesiologist has ordered PACU insulin and diabetes management using Anesthesia Diabetes (Insulin) Perioperative Plan

Routine Monitoring
• Check BG upon arrival to PACU, then every 30 minutes until child wakes from anesthesia, then hourly for 4 hours after

PACU Phase 1
HYPOglycemia Safety
• For glucose < 80 mg/dL, call provider and follow Diabetes: (Non-DKA) Hypoglycemia Management

HYPERglycemia Safety
• For glucose > 250 mg/dL
  • Notify anesthesia provider
  • Check BOHB
  • If BOHB ≥0.6 mmol/L, consult endocrine

On Continuous IV Insulin Infusion
1. Continue IV insulin infusion and admit to ICU - OR -
2. Convert to basal-bolus insulin injections
   • Anesthesiologist adjusts insulin infusion/glucose to maintain target BG 150 mg/dL
   • Inpatient provider orders basal-bolus insulin; stop continuous insulin infusion in PACU
   • Check BG within 30 minutes of stopping insulin infusion - OR -
3. For patient on home pump, may convert to home insulin pump
   • Competent caregiver required to be present at bedside
   • Anesthesiologist adjusts insulin infusion/glucose to maintain target BG 150 mg/dL
   • Inpatient provider ordering insulin enters insulin pump orders in the presence of caregiver and nurse if available
   • After recovery from anesthesia AND after orders are entered, patient/family restarts insulin pump, stop continuous insulin infusion in PACU
   • Check BG within 30 minutes of stopping insulin infusion

Continue Basal-Bolus Insulin
In PACU
• Order one time insulin dose based on home regimen. Use Humalog if home insulin type is not known.
  • If BG >250 mg/dL and it has been at least 3 hours since last rapid-acting dose, correct with rapid-acting insulin

Orders for Admission
• Inpatient provider orders basal-bolus subcutaneous insulin injections

Continue Home Insulin Pump
In PACU
• Caregiver verifies that insulin pump is infusing
  • Until caregiver is managing insulin pump, correct with subcutaneous rapid-acting insulin if it has been at least 3 hours since last rapid-acting dose.

Orders for Admission
• Inpatient provider ordering insulin enters insulin pump orders in the presence of caregiver and nurse if available
Insulin Sick Day Management for Diabetes (Non-DKA) v6.1

Inclusion Criteria
- Type 1 Diabetes (or at Endocrine attending discretion for CF-related or steroid-induced hyperglycemia) AND
- Moderate to large urine ketones OR Blood BOHB ≥ 0.6 mmol/L

Exclusion Criteria
- Diabetic ketoacidosis (DKA) (use instead DKA Pathway)
  - Intravenous insulin

BOHB ≥ 0.6 mmol/L OR moderate to large urine ketones

Call Provider to evaluate for Diabetic Ketoacidosis (DKA)
Has provider ordered Sick Day Management?

Provider consider insulin dose adjustment

Sick Day Management

Treatment
- Continue basal and rapid-acting insulin. Rapid-acting can be given for glucose correction every 3 hours (injection) or 2 hours (pump)
- Maintain good hydration
  - Give fluids, may require alternating carbohydrate-free and carb-containing fluids
  - Consider IV fluids if patient is unable to tolerate PO
- Do not use glucagon for hypoglycemia while ketones present

Monitoring
- Ensure unused IV available for blood draws
- Check BG and BOHB every 3 hours (injection) or 2 hours (pump)
  - Use capillary POC BOHB where available, or stat serum BOHB
  - If serum BOHB results unavailable after 30 minutes, check urine ketones
  - If serum glucose unavailable after 30 minutes or if concern for hypoglycemia, check fingerstick BG
  - Watch for signs of DKA (vomiting, persistent ketones not decreasing); evaluate for DKA (pH, electrolytes, BOHB) if signs are present

To calculate dose
- For subcutaneous insulin, use MAR calculator
- For insulin pump, see Sick Day Insulin Pump Job Aid (for SCH only)

* If BOHB and urine ketone results differ, base correction dose on BOHB

For elevated ketones and normal glucose, consider:
- Administer IV fluids to clear the ketones
- Add dextrose to IV fluids or give juice to increase glucose so more insulin can be given
- Verify plan with primary team and/or endocrine

BOHB <0.6 mmol/L OR NEGATIVE to SMALL urine ketones within previous 1 hour
Insulin dose = insulin to correct glucose + insulin to cover carbs

BOHB 0.6-1.5 mmol/L* OR MODERATE urine ketones within previous 1 hour
Insulin dose = (1.5x(insulin to correct glucose)) + insulin to cover carbs

BOHB >1.5 mmol/L* OR LARGE urine ketones within previous 1 hour
Insulin dose = (2x(insulin to correct glucose)) + insulin to cover carbs

Call inpatient provider to discontinue Sick Day Management
(ED Sick Day calculator will discontinue after each one-time insulin dose is used)

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Last Updated: April 2020
Next Expected Review: March 2024
Inclusion Criteria
- Glucose LESS THAN 80 mg/dL
- Patient receiving subcutaneous insulin (by pump or injection) or insulin in parenteral nutrition

Exclusion Criteria
- Patient on IV continuous insulin infusions (including diabetic ketoacidosis (DKA))
New Diagnosis Laboratory Evaluation

When Type 1 diabetes is suspected, order new onset labs to screen for complications and coexisting diseases (celiac disease, hypothyroidism), if not already done

- Glycosylated HbA1c
- Thyroxine Free
- Thyroid Stimulating Hormone
- Tissue Transglutaminase Antibody IgA
- Immunoglobulin A Level
- C Peptide
- Islet Cell Autoantibody Screen

Fasting plasma glucose (FPG) $\geq 126$ mg/dL*

OR

2-hr plasma glucose $\geq 200$ mg/dL during an Oral glucose Tolerance Test *

OR

In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose of $\geq 200$ mg/dL*

OR

In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose $\geq 200$ mg/dL

OR

Consider if A1C $\geq 6.5%$*

* Confirm by repeat testing

Clinical changes that affect glucose include

- Vomiting/diarrhea
- Change in dextrose rate or concentration of IV fluids
- Change in oral intake
- Changes in dosing or prescribing of medications that are likely to affect glucose, for example
  - Steroids
  - Tacrolimus, sirolimus
  - Cyclosporine
  - Beta-blockers can mask symptoms of hypoglycemia

Expert opinion
During hospitalization, the patient and family need to be equipped to manage diabetes safely at home:

- Identify provider who will provide diabetes care after discharge
- Understand diagnosis of diabetes, glucose monitoring, and explanation of home glucose results
- Define, recognize, treat, and prevent hyperglycemia and hypoglycemia
- When and how to take insulin
- Sick-day management
- Proper use and disposal of needles and syringes

Perioperative Recommendations

Use a glycemic target of 90-180 mg/dL perioperatively for surgeries, excluding CABG. [LOE: Guideline (Jefferies 2018, Diabetes Canada Clinical Practice Guide 2018)]

Contraindications to intraoperative insulin pumps include MRI, CT, and nuclear medicine scans; cardiac catheterization or AICD/pacemaker implantation; and therapeutic radiation oncology. Xray or fluoroscopy recommendations vary and pump may be covered with lead apron or be removed. Electrocautery is a theroretic risk, although pumps have been used safely in the presence of electrocautery. Ask patients if they have metal needles (Minimed Sure-T). [LOE: Guideline (Jefferies 2018)]

In a systematic review, authors were interested in the effects of Enhanced Recovery Surgery (ERAS), an evidence-based multimodal surgical pathway, on diabetic patients. No studies met inclusion criteria (Albalawi, 2017).
The 2018 ISPAD Sick Day Guideline recommends sick day dosing based on expert consensus

- For Elevated BG with an absence or only small amount of ketones: give 5-10% of the total daily dose of insulin (~0.05-0.1 U/kg) as short or rapid acting insulin, repeat every 2-4h according to BG response and clinical condition.
- For Elevated BG with moderate or large ketones: give 10-20% of the total daily dose of insulin (~0.1-0.2 U/kg) as short or rapid-acting insulin, repeat every 2-4h according to BG response and clinical condition.

No evidence on magnitude of benefit for various dosing alternatives was cited [LOE: Guideline (Laffel 2018)].

To make it easier for families to calculate this dose at home, our practice has adapted this recommendation to multiply the glucose correction by 1.5 or 2 based on ketones. This dosing strategy was introduced for inpatients in 2013.
Diabetes (Non-DKA) Approval & Citation

Approved by the CSW CSW Diabetes (Non-DKA) Pathway team for March 2019 go-live

CSW Diabetes (Non DKA) Pathway Team:

Endocrinology, Owner: Kate Ness, MD
Anesthesia: Lizabeth Martin, MD
Chief Resident: Kelly Dundon, MD
Clinical Nurse Specialist, Medical: Christine Delos Reyes, MN RN CPN
Clinical Nurse Specialist, Medical: Ellie McMahon, MSN RN CPN
Clinical Nurse Specialist, ED: Sara Fenstermacher, MSN RN ACCNS-P
Clinical Nurse Specialist, PACU: Pam Christensen, MN RN
Pharmacy: Kara Niedner, PharmD
Pharmacy: Jennifer Rasiah, PharmD

Clinical Effectiveness Team:

Consultant: Jennifer Hrachovec, PharmD MPH
Project Manager: Pauline O’Hare, RN MBA
CE Analyst: Holly Clifton
CIS Informatics: Carlos Villavicencio, MD MS/MI
CIS Informatics: Pedro Justino Diaz, PharmD
Librarian: Peggy Cruse, MLIS
Program Coordinator: Kristyn Simmons

Executive Approval:

Sr. VP, Chief Medical Officer Mark Del Beccaro, MD
Sr. VP, Chief Clinical Officer Madlyn Murrey, RN, MN
Surgeon-in-Chief Bob Sawin, MD


Please cite as:
This pathway was developed through local consensus based on published evidence and expert opinion as part of Clinical Standard Work at Seattle Children’s. Pathway teams include representatives from Medical, Subspecialty, and/or Surgical Services, Nursing, Pharmacy, Clinical Effectiveness, and other services as appropriate.

When possible, we used the GRADE method of rating evidence quality. Evidence is first assessed as to whether it is from randomized trial or cohort studies. The rating is then adjusted in the following manner (from: Guyatt G et al. J Clin Epidemiol. 2011;4:383-94.):

Quality ratings are *downgraded* if studies:
- Have serious limitations
- Have inconsistent results
- If evidence does not directly address clinical questions
- If estimates are imprecise OR
- If it is felt that there is substantial publication bias

Quality ratings are *upgraded* if it is felt that:
- The effect size is large
- If studies are designed in a way that confounding would likely underreport the magnitude of the effect OR
- If a dose-response gradient is evident

**Quality of Evidence:**
- 💫💫💫 High: The authors have a lot of confidence that the true effect is similar to the estimated effect
- 💫💫💫💫 Moderate: The authors believe that the true effect is probably close to the estimated effect
- 💫💫💫💫💫 Low: The true effect might be markedly different from the estimated effect
- 💫💫💫💫💫💫 Very low: The true effect is probably markedly different from the estimated effect

**Guideline:** Recommendation is from a published guideline that used methodology deemed acceptable by the team

**Expert Opinion:** Based on available evidence that does not meet GRADE criteria (for example, case-control studies).
Summary of Version Changes

- **Version 1.0 (5/21/2013)**: Go live
- **Version 1.1 (8/20/2013)**: Sick Day Management added
- **Version 1.2 (8/22/2013)**: ED wording changes, clarified sick day lab orders
- **Version 2.0 (2/10/2014)**: Sick Day Management: added a yellow alert triangle for a reminder to initiate
- **Version 3.0 (7/30/2014)**: Established Diagnosis: added guidance and recommendations for unreliable oral intake (Post-op, NPO) or vomiting
- **Version 3.1 (10/9/2014)**: Established Diagnosis: added basal insulin to Unreliable Oral Intake or NPO for clarity
- **Version 4.0 (3/30/2015)**: Perioperative Management added
- **Version 4.1 (10/25/2016)**: Added warning triangle to hypoglycemia page
- **Version 5.0 (1/6/2017)**: Rapid-acting insulin to be given at 0300 (removed instructions to give only if glucose >300mg/dL)
- **Version 5.1 (4/9/2018)**: Added postoperative inpatient provider ordering insulin
- **Version 5.2 (9/12/2018)**: Expanded availability of point of care BOHB test
- **Version 6.0 (3/25/2019)**: Updated literature review and implemented sick day for insulin pump
- **Version 6.1 (4/20/2020)**: Clarified guidance for sick day when glucose is normal
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Medicine is an ever-changing science. As new research and clinical experience broaden our knowledge, changes in treatment and drug therapy are required.

The authors have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication.

However, in view of the possibility of human error or changes in medical sciences, neither the authors nor Seattle Children’s Healthcare System nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for the results obtained from the use of such information.

Readers should confirm the information contained herein with other sources and are encouraged to consult with their health care provider before making any health care decision.
Studies were identified by searching electronic databases using search strategies developed and executed by a medical librarian. Searches were performed in June 2018. The search strategy used controlled subject indexing, where available, as well as text words to capture literature on the following concepts: diabetes mellitus and insulin, limited to pediatrics; diabetes mellitus and surgical procedures, sick day management, or inpatients; or, insulin infusion pumps or continuous glucose monitoring. All concepts were further limited to synthesis-level records using a standard Clinical Effectiveness filter. Searches were executed in Ovid Medline, Embase, Cochrane Database of Systematic Reviews, National Guideline Clearinghouse and TRIP. Retrieval was limited to English and records available from 2012 to date.

Flow diagram adapted from Moher D et al. BMJ 2009;339:bmj.b2535


