Example: GDM
(Asbru Version 5.6, after paper to BANFF 96; Dec. 2, 1996)

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We represented a portion of a guideline used at the Stanford University Medical Center for controlled observation and treatment of gestational diabetes mellitus (GMD) in ASBRU. The following guideline illustrates the an excerpt of monitoring gestational diabetes Type II (insulin-independent GDM, GMD Type II) after detecting GMD in the third trimester pregnancy and the insulin therapy in case of changing to the GMD Type I (insulin-dependent GDM) treatment. The aim is to manage GDM with diet and therefore without insulin therapy as long as possible. We represent parts of this guideline. Missing intentions and conditions have been acquired from domain experts.

GUIDELINE: Observation and Treatment of Gestational Diabetes Mellitus (GMD)

GLUCOSE MONITORING:
(after GDM was detected in third trimester pregnancy, tested by a glucose tolerance test (GTT) being between 140 and 200 mg/dl)

(1) Patients will check glucose values four times/day (fasting and one hour postprandial glucose)

(2) Preprandial, bedtime and 2 AM blood glucose will be added at the discretion of the physician

(3) One hour postprandial glucose is the time of the glucose peak for most patients. ... easier for patients to remember

(4) Treatment goals should be no higher than 130 mg/dl for 1-hour post meals, < 100 mg/dl fasting and preprandial

(5) Women with pregestational diabetes should be tested to see when they peak after meal. Gastroparesis may effect the timing of their glucose peak.
NUTRITION:
(1) Patients should be taught a diet based on the patients’ weight, activity level and number of fetuses:
   - carbohydrate (40-50%): milk, starch, fruits, vegetables
   - protein (20-25%, min. 0.75g/kg DBW + 10g/day)
   - fat (30-35%, ideally < 35%, unsaturated)
   - calcium (1200 mg/day)
   - iron (30 mg/elemental iron/day)
   - vitamin/mineral supplements
(2) Follow-up should be individualized (every 1-4 weeks based on needs)
(3) MAINTAIN regular meals (3 normal, 3 snacks) according to the diet

EDUCATION:
... deleted ...

INSULIN THERAPY:
(1) Indication: Blood sugar consistently > 100 mg/dl fasting and/or one hour postprandial consistently higher than 130 mg/dl. Attempts at diet modification have failed.
(2) The majority of patients can be started on insulin as outpatients. Indications for admission for insulin therapy are:
   - poor control in the first trimester
   - cognitive or psychosocial limitations for outpatient teaching
   - severe hyperglycemia
(3) Therapy should be individualized. A minimal number of injections should be used to obtain glycemic control. Some patients will require only one injection of NPH per day whereas brittle type I diabetics may need four-five injections per day using sliding scale.
(4) Two injections:
   - 0.7 (maternal weight in kg) = daily dose,
   - Distribution of insulin:
     - 2/3 (1/3 Regular, 2/3 NPH) in the morning
     - 1/3 (1/2 Regular, 1/2 NPH) in the evening
(5) Patients should be instructed on signs, symptoms and treatment of hypoglycemia, and sick day rules.
(6) Certain patients should be instructed on the treatment of elevated glucoses and insulin adjustments for exercise and dietary indiscretions.

GDM-Type II in ASBRU

MISSING:
Revision strategies: ON-SUSPEND ON-ABORT
INCLUDE/EXCLUDE Time annotation
Plan pointer: not with #<%INTEGER>
The plan body consists of three plans that are executed in parallel. These plans are decomposable into other plans, which are available in the guideline-specification library. Nondecomposable plans are executed by the executing agent. The plan names are written in bold characters.

(TIME-UNIT-ASSIGNMENT
  (WEEKS <-...)
  (DAYS <- ...)
)


(PLAN observing-GDM-Type-II

(DOMAIN-DEPENDENT TIME-ASSIGNMENT
 (SHIFTS DELIVERY <- 38 WEEKS)
 ;; time shift from CONCEPTION
 (POINT CONCEPTION <- (ask (ARG "what is the conception-date")))
)

(ABSTRACTION-ASSIGNMENT
 (CYCLICAL
   (MIDNIGHTS <- [0, 0 HOURS, 24 HOURS])
   (BREAKFAST-START-TIME <- [0, 7 HOURS, 24 HOURS])
   (LUNCH-START-TIME <- [0, 12 HOURS, 24 HOURS])
   (DINNER-START-TIME <- [0, 18 HOURS, 24 HOURS])

   (MORNINGS <-
    [[8 HOURS, 8 HOURS], [11 HOURS, 11 HOURS], [30 MINUTES, _],
     MIDNIGHTS] )
   (EVENINGS <-
    [[18 HOURS, 18 HOURS], [20 HOURS, 20 HOURS], [30 MINUTES, _],
     MIDNIGHTS])
)

(PREFERENCES
 (SELECT-METHOD EXACT-FIT)
 (START-CONDITION AUTOMATIC))

(INTENTION:INTERMEDIATE-STATE
 (MAINTAIN STATE(blood-glucose) (OR NORMAL SLIGHTLY-HIGH) GDM-Type-II
  [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY ], [_,_], CONCEPTION])
 ;; maintain normal or slightly-high blood-glucose level (all types)
 until delivery

 (MAINTAIN STATE(baby-growth) NORMAL GDM-Type-II
  [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION])

 (MAINTAIN STATE(fetal-movements) NORMAL GDM-Type-II
  [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION])

 (MAINTAIN STATE(mothers-body-weight-gain)
  (OR SLIGHTLY-LOW NORMAL SLIGHTLY-HIGH) GDM-Type-II
  [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION])
)

(INTENTION:INTERMEDIATE-ACTION
 (MAINTAIN diet regular-meals GDM-Type-II
  [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION])
)
;; manage GDM with diet

(INTENTION:OVERALL-STATE
 (AVOIDED STATE(blood-glucose) HIGH GDM-Type-II
  [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [7 DAYS,_],
  CONCEPTION])
 ;; high blood-glucose level (of any type) for more than 7 days)
(SETUP-PRECONDITIONS
  (PLAN-STATE one-hour-GTT COMPLETED
    [[24 WEEKS, 24 WEEKS], [26 WEEKS, 26 WEEKS], [_,_], CONCEPTION])
)(FILTER-PRECONDITIONS
  (one-hour-GTT (140, 200) pregnancy
    [24 WEEKS, 24 WEEKS], [26 WEEKS, 26 WEEKS], [_,_], CONCEPTION))
  ; GTT is true
(SUSPEND-CONDITIONS
  (STATE(blood-glucose) HIGH GDM-Type-II
    [[24 WEEKS,24 WEEKS], [DELIVERY, DELIVERY], [4 DAYS,_,], CONCEPTION]
    (SAMPLING-FREQUENCY 30 MINUTES)))
  ;; high blood-glucose level (of any type) for at least 4 DAYS
(ABORT-CONDITIONS (OR ACTIVATED SUSPENDED)
  (insulin-indicator-conditions TRUE GDM-Type-II *
    (SAMPLING-FREQUENCY 30 MINUTES)))
(COMPLETE-CONDITIONS
  (delivery TRUE * * (SAMPLING-FREQUENCY 30 MINUTES)))
(RESTART-CONDITIONS SUSPENDED
  (STATE(blood-glucose) (OR NORMAL SLIGHTLY-HIGH) GDM-Type-II
    [[24 WEEKS,24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION]
    (SAMPLING-FREQUENCY 30 MINUTES)))
  ;; normal or slightly high blood-glucose level (of any type)

(PLAN-EFFECTS (GDM-Type-II glucose NORMAL
  ([_, _], [_, _], [20 MINUTES, 60 MINUTES], *NOW*) 0.85))

(DO-ALL-TOGETHER
  (glucose-monitoring)
  (nutrition-management)
  (OBSERVE-insulin-indicators)
)
)
(PLAN glucose-monitoring

(PREFERENCES
  (SELECT-METHOD EXACT-FIT)
  (START-CONDITION AUTOMATIC))

(INTENTION:INTERMEDIATE-STATE
  (MAINTAIN STATE(blood-glucose)
    (OR NORMAL SLIGHTLY-HIGH)
    GDM-Type-II
    [[24 WEEKS, 24 WEEKS], [26 WEEKS, 26 WEEKS], [_,_], CONCEPTION])
  ;; normal or slightly blood-glucose level (of any type)
)

(INTENTION:INTERMEDIATE-ACTION
  (MAINTAIN
    (COUNT-APPEARANCE 1
      (STATE(blood-glucose) available
        GDM-Type-II
        [[0 HOURS,0 HOURS], [24 HOURS,24 HOURS], [_,_],
         (ACTIVATED glucose-monitoring)]))
  )
)

; monitoring blood-glucose once a day

(SETUP-PRECONDITIONS
  (glucometer-equipment-available TRUE GDM-Type-II *))

(FILTER-PRECONDITIONS
  (GDM-Type-II-diagnose TRUE pregnancy *))

(DO-ALL-TOGETHER
  (monitor-fasting-glucose (ARG NORMAL glucometer))
  (monitor-one-hour-after-breakfast-glucose
    (ARG NORMAL glucometer))
  (monitor-one-hour-after-lunch-glucose (ARG NORMAL glucometer))
  (monitor-one-hour-after-dinner-glucose (ARG NORMAL glucometer))
  (IF (physician-decided-more-analyses TRUE GDM-Type-II *)
    THEN (monitor-alternative-times
      (ARG NORMAL glucometer))
  )
)

(PLAN monitor-fasting-glucose (ARG glucose-value device)

(PREFERENCES
  (START-CONDITION AUTOMATIC))

(EVERY
  (START (FIRST(MIDNIGHT) after ACTIVATED *self*)
    ; first midnight after activated the current plan
    (TIME-BASE [[-1 HOURS, -1 HOURS], [-10 MINUTES, -10 MINUTES], [_,_],
      BREAKFAST-START-TIME])
  (UNTIL (COUNT-APPEARANCE 3
    (blood-glucose STATE(blood-glucose) HIGH GDM-Type-II
    [[24 WEEKS,24 WEEKS], [DELIVERY, DELIVERY],
     [3 DAYS,7 DAYS], CONCEPTION] ))
    ; elevated blood-glucose more than 3 times
  )
  (observe blood-glucose device glucose-value)

END-EVERY )
)
(PLAN monitor-one-hour-after-breakfast-glucose
(ARG glucose-value device)
(PREFERENCES
(START-CONDITION AUTOMATIC))
(EVERY
(START (FIRST(MIDNIGHT) after ACTIVATED *self*)
; first midnight after activated the current plan
(TIME-BASE [[1 HOURS, 1 HOURS], [2 HOURS, 2 HOURS], [...],
BREAKFAST-START-TIME])
(COMplete (UNTIL-COND (COUNT-APPEARANCE 3
(blood-glucose STATE(blood-glucose) HIGH GDM-Type-II
[[24 WEEKS,24 WEEKS], [DELIVERY, DELIVERY],
[3 DAYS,7 DAYS], CONCEPTION] )))
; elevated-blood-glucose more than 3 times
(observe blood-glucose device glucose-value)
END-EVERY)
)

(PLAN monitor-one-hour-after-lunch-glucose (ARG glucose-value device)
(PREFERENCES
(START-CONDITION AUTOMATIC))
(EVERY
(START (FIRST(MIDNIGHT) after ACTIVATED *self*)
; first midnight after activated the current plan
(TIME-BASE [[1 HOURS, 1 HOURS], [2 HOURS, 2 HOURS], [...],
LUNCH-START-TIME])
(COMplete (UNTIL-COND (COUNT-APPEARANCE 3
(blood-glucose STATE(blood-glucose) HIGH GDM-Type-II
[[24 WEEKS,24 WEEKS], [DELIVERY, DELIVERY],
[3 DAYS,7 DAYS], CONCEPTION] )))
; elevated-blood-glucose more than 3 times
(observe blood-glucose device glucose-value)
END-EVERY)
)

(PLAN monitor-one-hour-after-dinner-glucose (ARG glucose-value device)
(PREFERENCES
(START-CONDITION AUTOMATIC))
(EVERY
(START (FIRST(MIDNIGHT) after ACTIVATED *self*)
; first midnight after activated the current plan
(TIME-BASE [[1 HOURS, 1 HOURS], [2 HOURS, 2 HOURS], [...],
DINNER-START-TIME])
(COMplete (UNTIL-COND (COUNT-APPEARANCE 3
(blood-glucose STATE(blood-glucose) HIGH GDM-Type-II
[[24 WEEKS,24 WEEKS], [DELIVERY, DELIVERY],
[3 DAYS,7 DAYS], CONCEPTION] )))
; elevated-blood-glucose more than 3 times
(observe blood-glucose device glucose-value)
END-EVERY)
(PLAN monitor-alternative-times (ARG glucose-value device)
  (PREFERENCES
   (START-CONDITION AUTOMATIC))
  (DO-ALL-TOGETHER
   (monitor-one-hour-before-lunch-glucose (ARG NORMAL glucometer))
   (monitor-one-hour-before-dinner-glucose (ARG NORMAL glucometer))
   (monitor-bedtime-glucose (ARG NORMAL glucometer))
   (monitor-2AM-glucose (ARG NORMAL glucometer))
  )
)

(PLANS nutrition-management
  (PREFERENCES
   (SELECT-METHOD EXACT-FIT)
   (START-CONDITION AUTOMATIC))
  (INTENTION:INTERMEDIATE-STATE
   (MAINTAIN STATE(blood-glucose) (OR NORMAL SLIGHTLY-HIGH) GDM-Type-II
    [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION])
    ;; normal or slightly blood-glucose level (of any type)

   (MAINTAIN STATE(baby-growth) (NORMAL) GDM-Type-II
    [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION])

   (MAINTAIN STATE(fetal-movements) (NORMAL) GDM-Type-II
    [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION])
  )
  (INTENTION:INTERMEDIATE-ACTION
   (MAINTAIN diet regular-meals GDM-Type-II
    [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION])
  )
  (MAINTAIN STATE(mothers-body-weight-gain)
   (OR SLIGHTLY-LOW NORMAL SLIGHTLY-HIGH) GDM-Type-II
    [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [_,_], CONCEPTION])
    ;; low at the beginning of the diet then normal or slightly-high

  (INTENTION:OVERALL-STATE ;"more than 5 % weight-lost"
  )
  (INTENTION:OVERALL-ACTION
   (MAINTAIN visit-dietitian regularly GDM-Type-II
    [[24 WEEKS, 24 WEEKS], [DELIVERY, DELIVERY], [3 MONTHS,_], CONCEPTION])
    ;"visit dietitian regularly for at least three months"
  )

  (FILTER-PRECONDITIONS
   (GDM-Type-II-diagnosed TRUE GDM-Type-II *))

  (DO-ALL-TOGETHER
   (meals-according-to-diet)
   (visit-physician-again
    [[1 WEEKS,1 WEEKS], [4 WEEKS,4 WEEKS], [10 MINUTES,30 MINUTES],
     (ACTIVATED glucose-monitoring) ]
  )
)
(PLAN meals-according-to-diet
*** deleted ***
  (breakfast)
  (first-snack)
  (lunch)
  (second-snack)
  (dinner)
  (third-snack)
)
(PLAN OBSERVE-insulin-indicators
  *** deleted ***
  . )
(PLAN visit-physician-again