NMNEC Concept: **Metabolism**

Mega-Concept: Health and Illness

Category: Homeostasis & Regulation

Concept Name: Metabolism

Concept Definition:
Chemical and hormonal processes that influence cellular, tissue, or organ functions. Describes the processes of biochemical reactions that are necessary to produce energy, repair the body's cells, and maintain life.

Scope/Categories:

- **Scope:** Metabolic processes affect all cells of the body. Range on a continuum: catabolism to optimal balance to anabolism
  - Imbalance between energy intake and utilization

- **Categories:**
  - Glucose regulation
  - Thyroid regulation
  - Hepatic function
  - Hypothalamic–pituitary–adrenal axis (HPA)

Risk Factors:
Metabolic imbalances affect all individuals, regardless of age, gender, race, or socioeconomic status and usually occur as a consequence of an underlying condition.

Populations at Risk:

- Individuals with alterations in nutrition
- Individuals with underlying medical conditions or an illness requiring excess energy needs
- Gender: women are at higher risk for thyroid imbalances

- Racial/ethnic groups: African Americans, Hispanics/Latinos, American Indians, and Asian Americans are at highest risk for diabetes (American Diabetes Association [ADA], 2011, 2017; Centers for Disease Control and Prevention [CDC], 2011 2017)

Individual risk factors:

- Genetics: there are 40 known genetic markers associated with the risk of diabetes (McCarthy, 2011; Tipu, Ahmed, & Bashir, 2011).
- Underlying medical conditions
- Nutrition
- Medications, alcohol, other substances : can cause metabolic changes in the liver
- Smoking
- Infection
- Sedentary lifestyle

Physiologic Processes and Consequences:

- **Physiologic Processes:**
  - Regulation of hormonal secretion
    - Simple feedback
    - Negative and positive feedback
    - Complex feedback
    - Nervous system control
    - Failure in regulatory processes may result in systemic consequences
- **Consequences:**
  - Increased (high) metabolism
    - Relatively high basal metabolic rate (BMR)
    - More calories required for physiologic processes
    - Increased caloric need for life-sustaining processes
  - Decreased (low) metabolism
    - Relatively low BMR
    - Fewer calories required for physiologic processes
    - Decreased caloric need for-life sustaining processes
  - Dysfunctional cellular, tissue, organ, and systemic processes

Assessment/Attributes:

Subjective:

- Baseline history (past medical history, family health history)
  - There is a genetic component to many endocrine disorders
- Concerning symptoms, aggravating or relieving factors
- Medication use
- Nutritional assessment
- Social history (tobacco use, alcohol intake, recreational drug use)

Objective:

- Examination findings – disruptions in metabolism may vary among systems, depending on the metabolic disturbance
  - Integument (edema, jaundice, non-healing lesions, changes in the appearance of skin/hair
  - Head/neck (visual changes, exophthalmos, myxedema, goiter, acromegaly)
  - Cardiovascular (chest pain, dysrhythmias, hypertension, changes in pulses, bruising, ascites, hemorrhoids, changes in vital signs)
  - Gastrointestinal manifestations (nausea/vomiting, change in weight, heartburn, change in bowel habits)
  - Musculoskeletal (weakness, fatigue)
  - Mental status/sensory changes (mood or mental status, neurologic status, body image issues)
  - Urinary/reproductive changes (urine color, frequency, menstrual irregularities, decreased libido, decreased fertility)
  - Other (excessive thirst, excessive hunger, cold insensitivity, heat intolerance)
- Evaluation of body composition/weight, anthropometric measurements, body mass index, waist circumference

Diagnostic Tests:

- Laboratory testing
  - Nutritional panel: lipid profile, serum glucose, serum proteins, glycosylated hemoglobin (HbA1C)
  - Complete blood count
  - Basic metabolic panel
  - Nutrient levels: iron studies, vitamin levels (B12), minerals (zinc)

- Metabolic function studies: ultrasound, x-ray, computed tomography (CT), magnetic resonance imaging (MRI), endoscopic retrograde cholangiopancreatography (ERCP), serum enzymes, cortisol, aldosterone, bleeding and clotting factors
- Tests of thyroid function: thyroid-stimulating hormone (TSH) , antithyroid antibody, thyroxine/triiodothyronine (T3/T4)

Clinical Management – Interdisciplinary

Primary Prevention: Health Promotion

Patient education and community-based interventions

- Target healthy life style: regular physical activity, balanced diet, and avoid tobacco and substance abuse

Secondary Prevention: Screening

Screening of at-risk individuals

- Emphasis is placed on dietary & life style modifications that promote health

Tertiary Prevention: Prevention of Disease Progression

Treatment Varies Depending on the Cause of the Metabolic Abnormality

Collaborative interventions

- Nutritional support and education
- Fluid and electrolyte support
- Medical management
- Prevent and treat additional complications

Interrelated Concepts:

- Nutrition
- Cellular regulation
- Fluids & electrolyte balance
- Thermoregulation
- Elimination

Exemplars:

New Mexico Nursing Education Consortium (NMNEC) Required Exemplars:

- **Diabetes mellitus**: There are nearly 30.3 million individuals in the United States with diabetes, or 9.4% of the population (ADA, 2017; CDC, 2017, and another 84.1 million

with pre-diabetes (ADA, 2011; CDC, 2011, 2017). Diabetes is the leading cause of adult blindness, end-stage renal disease, and nontraumatic lower limb amputation (Micheal, 2011).

- **Thyroid imbalances:** Hypothyroidism is one of the most common medical disorders in the United States, affecting 1 in 50 women and 1 in 300 men (Carson, 2009), or 4.6% of the population over 12 years of age. Women are two to 10 times more likely than men to develop hypothyroidism or hyperthyroidism (Florida Hospital Statistics, 2018).

- **Exogenous adrenocortical dysfunction**

Optional Exemplars:

- Metabolic syndrome
- Pancreatitis

References:

American Diabetes Association. (2011). *Statistics about diabetes: Overall numbers, diabetes and prediabetes.* Retrieved from http://www.diabetes.org/diabetes-basics/statistics/

American Diabetes Association. (2017). *Diabetes statistics*. Retrieved from http://www.diabetes.org/diabetes-basics/statistics/

Carson, M. (2009). Assessment and management of patients with hypothyroidism. *Nursing Standard, 23*(18), 422-425.

Centers for Disease Control and Prevention. (2011). *National diabetes fact sheet, 2011.* Retrieved from https://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf

Centers for Disease Control and Prevention. (2017). *New CDC report: More than 100 million Americans have diabetes or prediabetes* [Press release]. Retrieved from https://www.cdc.gov/media/releases/2017/p0718-diabetes-report.html

Florida Hospital Statistics (2018) *Hypothyroidism*. Retrieved from https://www.floridahospital.com/hypothyroidism/statistics

McCarthy, M. I. (2011). Dorothy Hodgkin lecture 2010. From hype to hope? A journey through the genetics of type 2 diabetes. *Diabetic Medicine, 28*(2), 132-140.

Micheal, B. (2011). Nursing management: Diabetes mellitus. In S. L. Lewis & S. R. Dirksen (Eds.), *Medical surgical nursing: Assessment and management of clinical problems* (pp. 1218-1254) St. Louis, MO: Mosby Elsevier.

Tipu, H. N., Ahmed, T. A., & Bashir, MM. (2011). Human leukocyte antigen class ii susceptibility conferring alleles among non-insulin dependent diabetes mellitus patients. *Journal of the College and Surgeons, 21*(1), 132-140.

Resources:

Giddens, J. F. (2017). Hormonal Regulation. In J. F. Giddens (Ed.), *Concepts for nursing practice,* 2nd ed. (pp. 125-133). St. Louis, MO: Mosby/Elsevier.

Pearson Education. (2015). *Nursing: A concept based approach to nursing: Volume 1*. Boston, MA: Pearson.

Pereira, K. (2017). Glucose regulation. In J. F. Giddens (Ed.), *Concepts for nursing practice,* 2nd ed. (pp. 134-144). St. Louis, MO: Mosby/Elsevier.