Chapter 1

NUTRITION ASSESSMENT CHARTS, TABLES, AND FORMULAS

Author Note

The original content of this chapter remains with notation of changes that are reflective of the 2020 Update of the Nutrition Guidelines.

Where the guidelines suggest using your clinical judgement, information contained here may be helpful as it outlines expert opinion and past practices, techniques, procedures, and references.

PRACTICAL STEPS TO NUTRITION ASSESSMENT - ADULT CHRONIC KIDNEY DISEASE (CKD) PATIENTS

1. **Review the medical history** (concurrent diseases, drug/nutrient interactions, hospitalizations, wt changes, comparison of current wt to usual and standard, conditions that interfere with ingestion/absorption/mastication/elimination).
2. **Diet history** including "normal" for the pt and changes in appetite or intake, food intolerances, pica behavior, religious diet restrictions, past diet modifications and instruction, pt's understanding of diet and disease, educational level, pt's perspective of wt changes, food preferences, use of salt and sugar, food allergies, typical meal pattern/food frequency record, use of supplements/herbals, urine output, physical/economic/psychological problems, family/other support, activity level, and sleep patterns.
3. **Anthropometric and other measurements/physical examination:** measured ht, frame size, wt, SGA rating (pages 1-49 to 1-57), arm anthropometrics (triceps skinfold, mid-arm muscle circumference) (pages 1-43 to 1-48), waist circumference (WC), conicity index, creatinine kinetics (pages 1-40), handgrip strength, physical signs of malnutrition (pages 1-60 to 1-61), and general appearance.
4. **Review of biochemistries:** look for values that identify areas of concern (nutrition/immune status, state of uremia, bone status, electrolyte status, Fe status, vitamin/mineral status, hydration status, glycemic control).
5. **Assess current intake:** Kcal, carbohydrate, protein, fat, Na^+, K^+, Ca^{++}, P, fluid, vitamins, minerals.
6. **Assess/develop nutrition problem list using nutrition diagnostic terminology.**
7. **Determine/implement prioritized interventions.**
8. **Develop individualized diet prescription/meal pattern** with appropriate diet modifications for nutrition problems and individual preferences. Be as liberal as possible to promote adequate intake and good nutritional status.
9. **Instruct pt/other; provide written materials** at appropriate level of education/understanding.
10. **Follow-up within 1 to 3 mo** to assess appropriateness of diet modification as well as pt satisfaction and understanding. Modify plan as appropriate.
11. **Re-evaluate on a regular basis,** at least annually and/or whenever the pt has a change in status, such as significant wt change, extended hospitalization, or acute illness. Per CMS, a pt who is deemed unstable must be assessed monthly.

CENTERS FOR MEDICARE & MEDICAID SERVICES (CMS) CONDITIONS FOR COVERAGE (CfC)

In 2008, CMS published CfC (original version, 1976) for provision of services to ESKD pts.

The table provides an overview of the CfC and interpretative guidelines related to nutrition care and RDNs.

Topic	Mandate
Patient rights	Access to a qualified RDN, comprehensive nutrition assessment(s), individualized POC, and tailored counseling/education.
RDN	Registered with the CDR of the AND; 1 yr of professional work experience in clinical nutrition as an RDN. Renal nutrition is a specialized area within the practice of dietetics. The RDN may use a DTR to provide supervised assistance, but the RDN must meet the CfC. MNT for non-dialysis, dietitian qualifications: must be a RDN with the CDR or have a bachelor's degree or higher in nutrition or dietetics, 900 hr of supervised experience and state licensure, if applicable. The MNT dietitian qualifications allow a nutritionist who is not an RDN to provide MNT.
RDN responsibilities	The dialysis facility dietitian must be able to perform complex nutrition assessments, evaluate laboratory results, and assist the IDT in managing anemia, CKD-BMD, and adequacy of dialysis. Nutrition care includes assessment (eg, evaluation of nutrient intake, BW, biochemical indicators), diagnosis, intervention (eg, education, counseling, nutrient prescription/goals, meal pattern, supplementation), and monitoring/evaluation (eg, ongoing monitoring including monthly review of nutrition-related laboratory values with the pt). Other evidence-based, professionally accepted nutrition indicators are monitored as appropriate. The RDN is also expected to participate in pt care planning and the QAPI program.

Note: The CMS CfC were developed prior to the AND change in credentials from RD to RDN, but the intent of the CfC is to ensure that a qualified nutrition expert with specific training and experience is part of the IDT in dialysis centers. Thus, RD was changed to RDN in this table.

CMS CfC (cont.)

Topic	Mandate
Frequency of assessments	An initial assessment is required within the latter of **30 days or 13 treatments** after the initiation of dialysis. Subsequent assessments must occur **within 90 days** after the initial assessment (to evaluate pt adjustment), and **at least annually** thereafter. Patients who are deemed unstable by the IDT **require a monthly comprehensive assessment**. Unstable status is defined as extended or frequent hospitalizations, marked deterioration of health status, significant change in psychosocial needs or concurrent poor nutritional status, unmanaged anemia, and inadequate dialysis. Unstable status can also be assigned by the IDT even if the pt does not meet the defined criteria. **Transfer or modality change** requires reassessment within 30 days.
Components of nutrition assessment	**Monthly** review of laboratory results with pt; ongoing assessment of wt, volume status, albumin, adequacy parameters/dialysis prescription, and other accepted markers of nutritional status. Associated nutrition issues and interventions are documented to help guide IDT determination of pt status. **Routine assessments** include, but are not limited to, nutrition and hydration status; metabolic and glycemic control; cardiovascular health; anthropometric data (ht, wt, wt changes, volume status, amputations); appetite, intake, and route of nutrition; ability to chew and swallow; GI issues; use of medications, OTC products, and herbal products; previous diet modification/nutrition education; self-management skills and attitude toward nutrition, health, and well-being; motivation to make changes. See Introduction for Clinical Practice Guideline for Nutrition in Chronic Kidney Disease: 2020 Update.
Plan of care (POC)	Developed/updated within 15 days from any assessment in accordance with accepted clinical practice guidelines and CMS clinical performance measures; includes measurable and expected outcomes with realistic target dates. Requires progressive interventions and revised target dates that reflect ongoing monitoring and action. The initial POC must be completed within the **latter of 30 calendar days or 13 outpatient treatments**. The nutrition component of the POC outlines nutritional status, identified nutrition issues with established pt-specific goals, and planned interventions.

CMS CfC (cont.)

Topic	Mandate
Quality Assurance and Performance Improvement (QAPI)	Dialysis facilities must develop, implement, maintain, and evaluate an effective, data driven, QAPI program. Quality data will be used internally, with flexibility for the individual facility to develop formal QAPI projects in accordance with its own priorities. The RDN is required to participate with the IDT to monitor quality of services, identify areas for improvement, and conduct formal QAPI projects.

References: Department of Health and Human Services. CMS Conditions for Coverage for ESRD Facilities; Final Rule. 73 Federal Register. 4/15/2008. http://www.cms.gov/Regulations-and-Guidance/Legislation/CFCsAndCoPs/Downloads/ESRDfinalrule0415.pdf. Published 4/15/08. Accessed 7/4/2020.
CMS: End Stage Renal Disease Facilities. https://www.cms.gov/Regulations-and-Guidance/Legislation/CFCsAndCoPs/ESRD. Published 4/15/2008. Accesses 7/4/2020.
Academy of Nutrition and Dietetics. Qualifications of an RDN. https://www.eatright.org/food/resources/learn-more-about-rdns/qualifications-of-a-registered-dietitian-nutritionist. Published 3/9/20. Accessed 7/4/2020.

NUTRITION CARE PROCESS MODEL (NCPM)

The NCP is a systematic method that dietetics and nutritional professionals use to provide nutrition care and is visually summarized by the NCPM. The NCPM describes the NCP by presenting the workflow of professionals in diverse individual and population care delivery settings. Implementation of the NCPM has several advantages.

1. Uses a common framework for nutrition care and research
2. Promotes critical thinking
3. Fosters more-focused nutrition care documentation
4. Illustrates the value of nutrition care to other health-care professionals
5. Improves the application of evidence-based guidelines
6. Target audiences include practitioners, educators, students, professional credentialing agencies, health system accrediting agencies, health-care funding organizations, payers, and clients.

It illustrates the steps of the NCP along with internal and external factors that influence the application of the NCP.

Three themes are reflected in the NCPM: Use concise language, promote professional's responsibility for outcomes management, and support PCC. Screening and referral and outcomes management are also components of the model.

The NCP does not mean that all clients receive the same care, but provides a framework for professionals to customize care, considering the pt/client's needs and values as well as using the best evidence available to make decisions. Use of the NCP can lead to more efficient, effective care, promote nutrition research, and provide greater recognition of the role of dietetics/nutrition professionals in all settings.

This process is applicable to normal nutrition, illness, disease, and disease process, including CKD. Many aspects of the NCP have already been an integral part of nutrition care in CKD. The complexity of CKD and its many comorbidities, the mandates by oversight organizations, direction of pt advocacy groups, and attention of professional societies have stimulated the development of strong nutrition standards in CKD. Incorporation of NCP and standardized language (SL) into nutrition standards of CKD enhances the profile of nephrology nutrition.

(References on page 1-14.)

NCP Step 1: Nutrition Assessment

Purpose: Systemic approach to collect, classify, and synthesize important/relevant data to identify nutrition-related problems and their causes. Includes reassessment for comparison and re-evaluation of data from interaction to interaction and collection of new data that might lead to a new diagnosis based on the pt/client status. It is a dynamic process that involves initial assessment and continual re-assessment/analysis of pt/client status compared to accepted standards.

5 domains: Food/nutrition history; anthropometrics; biochemical data, medical tests/procedures; nutrition-focused physical findings; client history.

Data sources: Interview, observation, measurements; health record; and referring provider.

Critical thinking skills: Determining important/relevant data to collect; need for additional information; choosing the appropriate assessment tools and procedures for the situation; applying tools in a valid and reliable way; validating the data.

Use of data: Comparison to appropriate reference standards/recommendations/goals; communicating the nutrition diagnosis and setting goals.

NCP Step 2: Nutrition Diagnosis

Purpose: Provides RDN to identify and label an existing nutrition problem that he/she is responsible for treating. Nutrition diagnoses (eg, inadequate protein intake) are different than medical diagnoses (CKD).

Determining the diagnosis: Using standard nutrition diagnostic terminology, the pt/client nutrition diagnosis is reached through organized assessment data that are clustered for comparison with defining characteristics from an eNCPT reference sheet that includes definition, possible etiology, and common S/S as identified in step 1.

Terminology for nutrition diagnosis: Intake (NI) (too much/too little of food/nutrient compared to actual or estimated need); Clinical (NC) (nutrition problems related to medical/physical conditions); Behavior-environmental (NB) (knowledge, attitude, beliefs, physical environment, access to food/food safety).

Format: Problem, Etiology, Signs/symptoms (PES) statement. [Diagnosis/problem] related to [etiology] as evidenced by [S/S].

Critical thinking skills: Finding patterns/relationships among the data and possible causes; making inferences, stating problem clearly and singularly; ruling in/out specific diagnoses; identifying etiology that can be managed, improved, or resolved by nutrition interventions; identifying S/S signs/symptoms that can be measured/tracked; prioritizing the identified problems.

(References on page 1-14.)

NCP PROCESS AND TERMINOLOGY (cont.)

NCP Step 3: Nutrition Intervention

Definition: Purposefully planned action(s) designed with intent to change nutrition-related behavior, risk factor, environmental condition, or aspect of health status to improve or resolve the nutrition diagnosis (problem). Interventions are selected and tailored to pt/client needs.

Determination of interventions: Interventions are driven by the diagnosis and etiology and typically directed toward resolving the diagnosis by altering or eliminating the etiologies. Interventions may also be directed at relieving S/S. Interventions/goals are developed collaboratively with the pt/client and used to monitor progress and outcomes.

Domains: Food and nutrient delivery (customized approach for food/nutrient provision); **Nutrition education** (formal process to instruct or train in a skill, improve knowledge to help manage/modify food/nutrition/physical activity choices and behavior to maintain/improve health); **Nutrition counseling** (a supportive process, collaborative pt/client counselor relationship to establish care priorities, goals, action plans and foster self-care); **Coordination of nutrition care** (consultation/coordination/referral with other providers/institutions/agencies to assist in treating/managing nutrition problems); **Population based nutrition action** (designed to improve nutritional well-being of a population).

Terminology: Two distinct and interrelated steps – Planning and Intervention

Planning	Intervention
Prioritizing interventions based on urgency/impact/resources	Collaborating with pt/client to carry out POC
Collaborating with pt/client to identify goals of intervention	Communicating nutrition care plan
Writing nutrition prescription individualized to the pt/client	Modifying POC as needed
Selecting interventions focused on etiology/known to be effective	Follow-up to verify plan is being implemented
Defining time and frequency of care (intensity/duration/follow-up)	Revising strategies based on changes in condition or response

Critical thinking skills: Setting goals and prioritizing; defining nutrition prescription/basic plan; making interdisciplinary connections; matching interventions with pt/client needs, diagnoses, values; selecting appropriate alternatives to determine course of action; specifying time and frequency of care.

(References on page 1-14.)

Step 4: Nutrition Monitoring and Evaluation

Definition/purpose: Determining and measuring progress made with the nutrition intervention(s) and whether goals/outcomes are being met. Promotes uniformity within nutrition/dietetics for assessing effectiveness of interventions and identifies outcomes/indicators relevant to diagnoses, intervention plans/goals. Outcomes/indicators are determined at the first interaction and subsequently monitored. Selection of indicators should consider medical diagnoses, health-care outcomes, pt/client goals, quality goals, practice setting, client population, and disease state/severity.

Terminology/domains: Food/nutrition-related history outcomes (food/nutrient intake/administration, medications, complimentary/alternative medicine use, knowledge/beliefs, available food/supplies, physical activity, nutrition quality of life); A**nthropometric measure outcomes** (ht, wt, BMI, growth pattern indices, percentile ranks, wt history); **Biochemical data, medical tests/procedure outcomes** (eg, lab data, tests, resting metabolic rate); **Nutrition-focused physical exam** (physical appearance, fat/muscle wasting, swallow function, appetite).

Use of monitoring and evaluation outcome data: Includes 3 components (monitoring, measuring, evaluating changes in nutrition care indicators) providing evidence that the nutrition intervention(s) is or is not changing behavior or status. It includes comparing current findings with previous status/intervention goals/reference standards. The use of standardized indicators and criteria enhances the validity/reliability of outcome data collection, communication, and aggregation of data to report outcomes of specific interventions.

Critical thinking skills: Using appropriate reference standards for comparison, recognizing/defining the changes in pt status compared to expected, explaining variance from expected outcomes, determining factors that help or hinder progress, deciding between discharge and continuation of care.

Other:

Electronic Nutrition Care Process Terminology (eNCPT is a Web-based comprehensive guide for implementing NCP with SL that offers peer-reviewed content along with easy navigation, modern functionality, improved site organization, and language translations.

Academy of Nutrition and Dietetics Health Information Infrastructure (ANDHII) is a Web-based platform for tracking nutrition care outcomes and advancing evidence-based research with secure, on-line data collection using familiar NCPT in a format that is easy to integrate into practice flow. It facilitates multi-site experimental research, allows secure upload of informed consent documents with a variety of privacy and compliance configurations/standardizations.

Evidence Analysis Library serves as the context for evidence analysis questions that help RDNs to appropriately formulate the NCP.

(References on page 1-14.)

NCP: NUTRITION DIAGNOSTIC STATEMENTS PROBLEM/ETIOLOGY/SIGNS AND SYMPTOMS (PES)

Problem	Describes changes or abnormalities in a pt/client's nutritional status. Problem should be one that the RDN can resolve/improve or lessen S/S. When all things are equal and there are nutrition diagnoses from different domains, use the NI nutrition diagnosis (see page 1-12) as the one more specific to the RDN.
Etiology	Cause/contributing risk factors, linked to the diagnosis term by the words "related to." Evaluate whether the etiology for each problem is the specific root cause that can be addressed with a nutrition intervention. If the intervention cannot resolve the problem, can it at least lessen the S/S.
Signs and Symptoms (S/S)	Data/indicators that are used to determine the nutrition diagnosis. These are linked to the etiology by the words "as evidenced by." Make sure the S/S are specific enough to monitor the problem, determine whether they will indicate that a problem is resolved or improved, and can they communicate the resolution or improvement.

Characteristics of a well-written PES:

- All aspects (P-E-S) are supported by the nutrition assessment data
- Clear and concise
- Specific to pt/group
- Describes only 1 problem, although there may be more than 1 statement per chart note
- Is related to an etiology that is the root cause of the nutrition diagnosis and that a dietitian can resolve or affect
- Based on appropriate/accurate S/S data from the assessment phase of NCP

CKD Example: Inadequate protein intake (problem) related to uremic anorexia (etiology) as evidenced by reported protein intake of <0.8 g/kg BW, nPNA of 0.75 g/kg BW (S/S).

(References on page 1-14.)

COMMON NUTRITION DIAGNOSTIC TERMS FOR CKD

INTAKE (NI) actual or estimated of specific nutrient/group compared to desired levels	
Energy balance, changes in energy (calorie/kcal/kJ) balance	Increased energy expenditure Inadequate/excessive energy intake Predicted suboptimal/excessive energy intake
Oral or nutrition support intake	Inadequate/excessive oral intake
Fluid intake	Inadequate/excessive fluid intake
Bioactive substances	Suboptimal/excessive bioactive substance intake
Nutrient(s)	Increased needs (specify) Malnutrition Inadequate protein/energy intake Imbalance of nutrients
Fat/CHOL	Less-than-optimal/excessive intake of types of fats
Protein	Inadequate/excessive protein intake Less than optimal intake of protein/aa types (specify)
Mineral	Inadequate/excessive mineral intake
Multi-nutrient	Predicted suboptimal/excessive nutrient intake (specify)

(References on page 1-14.)

COMMON NUTRITION DIAGNOSTIC TERMS FOR CKD (cont.)

CLINICAL (NC) Nutrition findings/problems identified that relate to medical or physical conditions	
Functional: Change in physical or mechanical functioning that interferes with/prevents desired nutrition	Swallowing difficulty Biting/chewing (masticatory) difficulty Altered GI function
Biochemical: Change in capacity to metabolize nutrients due to meds, surgery, or as indicated by altered lab values	Impaired nutrient utilization Altered nutrition-related laboratory values Food-medication interaction
Weight: Chronic wt or changed wt compared with usual or desired	Underweight Overweight/obesity Unintended wt loss Unintended wt gain
BEHAVIORAL-ENVIRONMENTAL (NB) Findings/problems identified that relate to knowledge, attitudes/beliefs, physical environment, access to food, or food safety	
K**nowledge and beliefs**	Food- and nutrition-related knowledge deficit Not ready for diet/lifestyle change Self-monitoring deficit Limited adherence to nutrition-related recommendations Undesirable food choices
Physical activity and function	Physical inactivity Inability to manage self-care Impaired ability to prepare foods/meals Self-feeding difficulty
Other: Findings not classified as any above	No nutrition diagnosis currently

(References on page 1-14.)

Assessment: pt has serum K^+ of 6.3 mEq/L and reports high dietary intake of high K^+ foods	Nutrition-related problem that can be diagnosed; identified monthly laboratory review/pt interview
Diagnosis: Excessive intake of dietary K^+ related to ingestion of seasonal fresh fruit as evidenced by serum K^+ and dietary recall indicating 3.3 g K^+ intake versus recommended 2.5 g K^+	Diagnostic statement provides a clear picture of problem and the nutrition-related aspects of that problem
Intervention: Reinforce nutrition prescription/meal pattern with 2.5 g or less of dietary K^+. Nutrition education on high K+ fruits, frequency of use, reasonable portion sizes, alternate choices	Collaborate w/pt to determine the intervention(s) that are agreed upon and most likely to address the problem and improve or resolve the diagnosis
Monitoring/Evaluation: Pt agrees with and can restate plan/goals to reduce dietary K^+ intake. Redraw K^+ levels weekly until resolved	Use dietary recall and laboratory results to gauge pt understanding and adherence to the nutrition care plan. Adjust interventions as required. (Different dialysate, medications, lower recommended diet level.)

NCP References

AND. NCP 101 https://www.eatrightpro.org/practice/quality-management/nutrition-care-process/ncp-101. Accessed 7/4/2020.
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NCP Terminology (NCPT) https://www.andeal.org/vault/2440/web/files/EAL/NCP_EAL_201711.pdf. Accessed 7/5/2020.
Nutrition diagnostic codes. https://retnotbs.files.wordpress.com/2013/04/02-0-nutrition-diagnostic-terminology5.pdf. Published 2013. Accessed 7/5/2020.

MEDICAL NUTRITION THERAPY (MNT)

National Institutes of Health defines MNT as treatment based on nutrition, including checking nutrition status and giving specific foods/nutrients to treat conditions, such as those caused by DM or CKD. MNT is overseen by a nutrition professional/RDN only through referral by MD (primary care or specialist) who is coordinating care for the beneficiary indicating the diagnosis and medical necessity of MNT. MNT may include an initial nutritional/lifestyle assessment, nutritional counseling (food selection, meal plans, lifestyle factors, etc.), and follow-up visits (to check on your progress). In rural areas, a dietitian may provide services through telehealth. *The Clinical Practice Guidelines for Nutrition Care in CKD recommend MNT for adults with CKD 1-5D with the goals of optimizing nutritional status, minimizing risks imposed by comorbidities and alterations in metabolism on the progression of kidney disease and on adverse outcomes.*

CMS covers MNT for (1) DM and (2) chronic renal insufficiency (non-dialysis) or post kidney transplantation (within 36 mo).

MNT for those on dialysis is provided within the payment for dialysis services.

Current Procedural Terminology (CPT) Codes:

97802 – MNT; initial assessment/intervention, individual, face-to-face with the pt, billed in 15-min intervals

97803 – Reassessment and intervention, individual, face-to-face with the pt, billed in 15-min intervals

97804 – Group (2 or more individuals), billed in 30-min intervals

Coverage: 3 hr in initial calendar year and 2 follow-up hours in subsequent years with physician referral

Additional G Codes for extra hours when the attending MD determines a change of diagnosis/condition requires an additional diet modification.

G0270: MNT reassessment and subsequent intervention(s) for change in diagnosis, individual, each 15 min

G0271: MNT reassessment and subsequent intervention(s) for change in diagnosis, group (2 or more), each 30 min

Examples of Diagnosis Codes for MNT

Diabetes diagnostic codes identify DM type, body system affected, DM complications/manifestations	**CKD** based on severity designated by stages 1-4	**Kidney Transplantation**
E10.2 Type 1 DM w/kidney complications E10.5 Type 1 DM w/circulatory complications E10.65 Type 1 DM w/hyperglycemia E10.9 Type 1 DM without complications E11.4 Type 2 DM with neurological complications E11.64 Type 2 DM with hypoglycemia E11.8 Type 2 DM with unspecified complications	N18.5 CKD stage 5 non-dialysis (GFR < 15) N18.4 CKD Stage 4 N18.3 CKD Stage 3	Z94.0 Kidney transplantation status

Note: The Medical Nutrition Therapy Act 2020 HR6971 introduced in the House of Representatives on 5/22/20 would expand MNT under Medicare to include nutrition therapy for hypertension, prediabetes, dyslipidemia, malnutrition, eating disorders, celiac disease, HIV/AIDS, and any other disease or condition that causes unintentional wt loss. It also expands the professionals allowed to furnish MNT to include physicians, nurse practitioners, nurse specialists, and in the case of eating disorders, clinical psychologists. It also outlines that MNT is provided to those on dialysis as part of their dialysis reimbursement.

References:

CMS. Medicare Preventive Services. Medical Nutrition Therapy. https://www.cms.gov/Medicare/Prevention/PrevntionGenInfo/medicare-preventive-services/MPS-QuickReferenceChart-1.html#MNT. Published 6/20. Accessed 7/16/2020.
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AND. Quick Guide to the Medicare MNT Benefit. https://dpg-storage.s3.amazonaws.com/dce/resources/quickmntbenefitguide.pdf. Published 7/02. Accessed 7/16/2020.
Ikizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.

Clinical Practice Guideline for Nutrition in CKD: 2020 Update Nutrition Assessment Recommendations

(To be performed by RDN or international equivalent)

Task	Stage	Tools	Frequency	Comment/Instruction
Routine nutrition screening	CKD 3-5D Posttransplantation	Limited evidence to use 1 tool over others	≥ Biannually	Intent of identifying those at risk for PEW
Routine nutrition assessment	CKD 3-5D Posttransplantation	Comprehensive assessment*	As indicated by screening or provider referral	Monitoring/reassessment

*Comprehensive assessment including but not limited to appetite, history of dietary intake, biochemical data, anthropometric measures, and nutrition-focused physical findings.

Components of Nutrition Assessment

Task	Tools	Stage	Frequency	Comment/Instruction
Body composition	BIA, multi-frequency preferred	CKD 3-5D Posttransplantation	NA	Based on the rate at which electrical current travels through the body. If available, perform a minimum of 30 min post-dialysis to allow redistribution of body fluids. Insufficient evidence to recommend using in non-dialyzed or PD
	DXA	CKD 1-5D Posttransplantation	NA	If feasible. DXA remains gold standard, although results can be influenced by volume status
	BW	CKD 1-3 CKD 4-5, posttransplantation MHD, PD	Q 6 mo Q 3 mo Q mo	Use clinical judgment to determine method of measuring BW d/t absence of standard reference norms (actual measured wt, wt history, serial wts, adjustments for edema, ascites, polycystic organs, amputations)

Components of Nutrition Assessment (cont.)

Task	Tools	Stage	Frequency	Comment/Instruction
Body composition (cont.)	BMI	As above	As above	Under wt based on BMI can be used as a predictor of higher mortality in MHD, PD, non-dialysis, and posttransplantation. Morbid obesity can be used as a predictor of higher mortality in MHD. Overweight/obese status based on BMI can be used as a predictor of lower mortality in MHD but higher mortality in posttransplantation. The effect of overweight/obesity status on mortality is unclear in non-dialyzed. BMI alone is insufficient to diagnose PEW unless it is very low BMI (<18 kg/m^2)
	Skinfold thickness	CKD 1-5D Posttransplantation	NA	In the absence of edema, measurement of skinfold thickness can be used to assess body fat
	Waist circumference	CKD 5D	NA	May be used to assess abdominal obesity, but reliability is low for assessing changes over time
Note: Timing of body composition measures is important due to changing hydration in CKD. None of the methods are perfect, and errors should not be ignored; availability of suitable reference standards is also a limitation, although over time the pt can serve as his/her own reference to note changes. Anthropometrics are a practical, inexpensive, and non-invasive way to describe body mass, size, shape, and composition (ht, wt, skinfold, waist circumference). BIA, DXA, creatinine kinetics require additional equipment and/or laboratory tests.				
Conicity index		CKD MHD	NA	May be used to assess nutritional status and as a predictor of mortality based on beliefs that central rather than general obesity is associated w/ CV disease $CI = \frac{\text{waist circumference (m)}}{0.109\sqrt{\frac{\text{weight (kg)}}{\text{height (m)}}}}$
Creatinine kinetics	Blood/urine collections	CKD 5D	NA	May be used to estimate muscle mass, although very high or low dietary meat intake or creatine supplements skews value

Components of Nutrition Assessment (cont.)

Task	Tools	Stage	Frequency	Comment/Instruction
Laboratory measurements	Serum albumin, prealbumin, nPCR	CKD 1-5D Posttransplantation	NA	May be considered as complementary tools to assess nutritional status but should not be interpreted in isolation since they are influenced by non-nutritional factors. In MHD, low serum albumin (< 3.5 g/dL) may be used as a predictor for hospitalization and mortality
Handgrip strength		CKD 1-5D	NA	May be used as a surrogate measure of protein-energy and functional status when baseline data are available
Nutrient requirements	REE	CKD 1-5D Posttransplantation	NA	Reasonable to use indirect calorimetry (gold standard) to measure REE when possible and indicated
	REE equations	CKD MHD	NA	In the absence of indirect calorimetry, disease-specific predictive energy equations may be used to estimate REE, they include factors that influence metabolic rate in this population
Composite nutritional indices	7-point SGA	CKD 5D	NA	Considered a valid and reliable tool for assessing nutritional status (see pages 1-50 to 1-58)
	MIS	CKD MHD, Posttransplantation	NA	Score may be used to assess nutritional status (see pages 1-59 to 1-61)

Components of Nutrition Assessment (cont.)

Task	Tools	Stage	Frequency	Comment/Instruction
Dietary intake	3-day food record	CKD 3-5D	NA	Preferred method includes dialysis and non-dialysis day as appropriate. Also, reasonable to assess weekday, weekend day, or consider including days where intake may be significantly different
	24-hr food recall, FFQ, nPCR	CKD 3-5 CKD 5D	NA	May be considered alternative ways to assess dietary energy and protein intake
	Other considerations		NA	Assess factors beyond just intake, such as medications use, knowledge, beliefs, attitudes, behaviors, access to food, depression, cognitive function, etc., to help plan nutrition interventions

Reference: Ikizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.

GENERAL TIPS FOR EFFECTIVE ASSESSMENT, INTERVIEWING, AND TEACHING

- **Introduce yourself.**
- **Make eye contact** and use a receptive posture.
- **Establish rapport.**
- **Explain** what you will be doing.
- **Assess prior learning.**
- **Tailor information to the individual's** knowledge, literacy level, and readiness to change.
- **Ask open-ended questions** without leading responses.
- **Utilize food models** or other references to enhance accuracy of pt responses.
- **Acknowledge pt responses.**
- **When possible, allow the pt to choose the topic.**
- **Tailor the time spent, and the volume of information given at each session based on pt's readiness.**
- **Give written material** to reinforce verbal instructions.
- **Seek, identify, and use** pt-specific motivational factors.
- **Encourage the pt to** participate in his or her own nutrition care and to ask questions.
- **Set goals with the pt,** not for the pt.
- **Act as a coach or advisor rather than an authoritarian.**

These tips are in line with known methods of pt engagement, such as Motivational Interviewing (MI) and Patient Activation Measure (PAM). Assessing the pt's readiness for change and/or level of activation will help focus education and counseling activities, improve efficiency, and promote successful outcomes.

MOTIVATIONAL INTERVIEWING AND PATIENT ACTIVATION MEASURE

MI and PAM provide insights about engaging pts in their own self-management. MI is a collaborative person-centered form of guidance to elicit and strengthen motivation for change. It recognizes 5 stages of change. PAM is based on the concept that activation is understanding that one must take charge of his/her health and that actions determine outcomes. It includes 4 stages of activation. These 2 methods of pt engagement have similar stages and are seemingly complimentary.

MI: Stages of Change	PAM: Stages of Activation
Pre-contemplative: not ready to consider change	
Contemplation Stage: ready to consider change, mixed feelings; may see benefits and drawbacks	Believes that an active role in own health care is most important in determining health and ability to function
Preparation: ready to make changes; planning actions and changes	Confidence and knowledge to act at home
Action: enacting plans and goals; establishing new habits	Taking action to handle symptoms of health condition(s) on his/her own (eg, changes in lifestyle as recommended)
Maintenance: dealing with relapses; reinforcing	Staying the course under stress; handling new situations or problems with confidence

References: Miller WR, Rollnick S. *Motivational Interviewing: Helping people change.* 3rd ed. New York, London: The Guilford Press; 2013.
Constance A, Sauter C. *Inspiring and Supporting Behavior Change: A Food and Nutrition Professional's Counseling Guide.* Chicago: Academy of Nutrition and Dietetics; 2001.
Hibbard JH, Stockard J, Mahoney ER, Tusler M. Development of the Patient Activation Measure (PAM):
conceptualizing and measuring activation in patients and consumers. *Health Serv Res.* 2004;39(4 Pt 1):1005-1026.

MOTIVATIONAL INTERVIEWING

Most health-care counseling techniques were established for acute (short duration) conditions where pt participation is seen as less important. In chronic disease, most of the care is done by the pt (self-management) between appointments or treatments. In CKD, it is more effective for the health-care provider to be a coach or an advisor while encouraging the pt to be proactive and engaged in decision making around his or her care. In traditional counseling the professional provides information based on what he or she thinks the pt needs to know. A pt-focused approach encourages questions and input from the pt to guide counseling topics and goal setting.

Traditional Interviewing	Motivational Interviewing
Focus on fixing problem	Focus on pt concerns
Paternalistic	Partnership
Assumes pt motivation	Matches intervention to pt
Advise and warn, turn up the volume	Strengthens reasons to change
Ambivalence is seen as denial	Ambivalence is normal
Resistance is seen as non-compliance	Expects some resistance
Recommends goals	Sets goals collaboratively

References: Miller WR, Rollnick S. *Motivational Interviewing: Helping People Change.* 3rd ed. New York, London: The Guilford Press; 2013.
Constance A, Sauter C. *Inspiring and Supporting Behavior Change: A Food and Nutrition Professional's Counseling Guide.* Chicago: Academy of Nutrition and Dietetics; 2001.
Sanders KA, Whited A, Martino S. Motivational Interviewing for patients with chronic kidney disease. *Sems in Dial.* 2013;26(2):175-179.

DETERMINATION OF PATIENT HEIGHT*

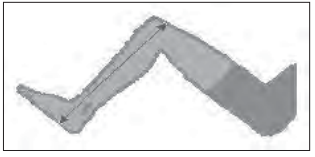
A measured ht is the best method for determination of stature. A standard process helps ensure that pt hts are accurate and consistent.

1. Have the pt stand with his/her back to the measuring surface/wall, looking straight ahead.
2. The back of the head, shoulders, buttocks, and heels should be touching the measurement surface.
3. The shoulders should be relaxed and the arms at the sides of the body.
4. The legs should be straight with the knees together.
5. The feet should be flat on the floor and the heels close together.
6. Have the pt inhale deeply and stand fully erect.
7. Apply a horizontal bar snugly to the crown of the head, compressing the hair as needed.
8. Record the ht to the nearest 0.1 cm.

*__Frame size__ is supplemental to ht and, thus, enhances the value of ht/wt tables. Many sites have been proposed for the estimate of frame size. There is general agreement that surrogate measures should be distributed normally within a population, be highly correlated to LBM, and not be correlated to fat. Elbow breadth is considered as the best measure of frame size; it is validated, has reference standards and is relatively simple. See pages 1-27 through 1-29 for frame size determinations.

References: NHANES III. Body Measurements. C:/Users/nkf/Downloads/BodyMeasurementsAnthropometry.pdf. Published 10/88. Accessed 7/16/2020.
Simko MD, Cowell C, Gilbride JA, eds. *Nutrition Assessment: A Comprehensive Guide for Planning Intervention.* 2nd ed. Gaithersburg, MD: Aspen Publishers; 1995.

HEIGHT ESTIMATION FROM KNEE HEIGHT*



Knee ht is correlated with stature and may be used to estimate ht in persons who are unable to stand. While lying supine, both the knee and ankle of the pt are held at 90-degree angles. One blade of a knee ht caliper is placed under the heel and the other blade is placed on the anterior surface of the thigh. The shaft of the caliper is held parallel to the long axis of the lower leg and pressure is applied to the tissue to measure the distance from the heel to the top of the knee. Height in cm is calculated using the formulas below. Use the non-access leg if the pt has a leg access. Take 2 successive measurements.

They should agree within 5 mm.

Male ht (cm) = 64.19 - (0.04 × age) + (2.03 × knee ht)
Female ht (cm) = 84.88 – (0.24 × age) + (1.83 × knee ht)

Reference: Chumlea WC, Roche AF, Steinbaugh ML. Estimating stature from knee ht for persons 60 to 90 yr of age. *J Am Geriatric Soc.* 1985;33:116-120.

***Knee ht can also be performed with the pt sitting upright in a chair.**

Reference: CDC. NHANES III. Body measurements. C:/Users/nkf/Downloads/BodyMeasurementsAnthropometry.pdf. Published 10/88. Accessed 7/16/20.

HEIGHT ESTIMATION FROM ARM SPAN

Arm span is approximately equal to ht (within 10% error) in both men and women, although it usually slightly overestimates ht. With the arms fully extended and parallel to the ground, measure the distance from the tip of the middle finger on 1 hand to the tip of the middle finger on the other hand. It may be easiest to measure across the pt's back.

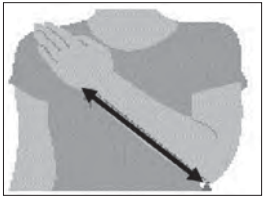
Reference: Chumlea WC, Roche AF. *Nutritional Assessment of the Elderly through Anthropometry.* Columbus, OH: Ross Laboratories; 1987.

HEIGHT ESTIMATION FROM DEMI-SPAN

Demi-span is the distance from the middle of the sternal notch to the tip of the middle finger in the coronal plane of the left or non-access arm. Check to be sure that the arm is horizontal and level with the shoulders. Use the formulas below to calculate ht.

Male ht (cm) = (1.40 × demi-span cm) + 57.8
Female ht (cm) = (1.35 × demi-span cm) + 60.1

HEIGHT ESTIMATION FROM FOREARM



Measure between the point of the elbow and the midpoint of the prominent bone of the wrist. Height in cm can be determined from the chart below. Find the appropriate ulna length (cm) then read up for male, using the row that corresponds with the age (> or <65 yr). For example: an ulna measurement of 32 cm estimates a ht of 187 cm for a male older than 65 yr, a ht of 184 for a woman younger than 65 yr.

Male <65 yr	194	193	191	189	187	185	184	182	180	178	176	175	173	171
Male >65 yr	187	186	184	182	181	179	178	176	175	173	171	170	168	167
Ulna length (cm)	**32**	**31.5**	**31**	**30.5**	**30**	**29.5**	**29**	**28.5**	**28**	**27.5**	**27**	**26.5**	**26**	**25.5**
Female <65 yr	184	183	181	180	179	177	176	175	173	172	170	169	168	166
Female >65 yr	184	183	181	179	178	176	175	173	171	170	168	166	165	163
Male <65 yr	169	167	166	164	162	160	158	157	155	153	151	149	148	146
Male >65 yr	165	163	162	160	159	157	156	154	152	151	149	148	146	145
Ulna length (cm)	**25**	**24.5**	**24**	**23.5**	**23**	**22.5**	**22**	**21.5**	**21**	**20.5**	**20**	**19.5**	**19**	**18.5**
Female <65 yr	165	163	162	161	159	158	156	155	154	152	151	150	148	147
Female >65 yr	161	160	158	156	155	153	152	150	148	147	145	144	142	140

Note: All these measures provide reasonable estimates of ht in normally proportioned adults.
Reference: RxKinetics. Estimating height in bedridden patients. http://www.rxkinetics.com/height_estimate.html. Accessed 7/16/20.

DETERMINATION OF FRAME SIZE

Note: While frame size (bone structure) is not addressed as a recommended measurement in the Clinical Practice Guidelines for Nutrition in CKD: 2020 Update, it is reasonable to estimate the frame size for a more accurate determination of desirable wt. Several of the potential reference standards for measurement of wt include frame size. There are several methods to determine frame size included here that can be performed during anthropometric assessment. None of them have been validated in CKD, but any of them should be able to provide an estimate of the bone structure that influences BW. It is important to standardize on 1 method for those practice settings where pt data are compared.

FRAME SIZE USING ELBOW BREADTH

1. Have the pt stand, facing you with feet together. Ask him or her to extend the right arm in front of the body with the forearm at a 90-degree angle, the inside of arm facing the body, and the fingers pointing up.
2. Place the thumb and index finger (or calipers with blades up*) against the 2 prominent bones on either side of the elbow; exert firm pressure to minimize influence of soft tissue, measure the distance between your thumb and index finger or the caliper blades. Take the reading while the arm is still bent and in the caliper, and measure to the nearest 0.1 cm. Measure twice and use the average of the 2 measurements.
3. Determine the frame size on the chart below using the pt's ht and elbow breadth. Use frame size to determine SBW or IBW.

	Male			Female		
Age	**Small**	**Medium**	**Large**	**Small**	**Medium**	**Large**
18-24	≤6.6	>6.6 and <7.7	≥7.7	≤5.6	>5.6 and <6.5	≥6.5
25-34	≤6.7	>6.7 and <7.9	≥7.9	≤5.7	>5.7 and <6.8	≥6.8
35-44	≤6.7	>6.7 and <8.0	≥8.0	≤5.7	>5.7 and <7.1	≥7.1
45-54	≤6.7	>6.7 and <8.1	≥8.1	≤5.7	>5.7 and <7.2	≥7.2
55-64	≤6.7	>6.7 and <8.1	≥8.1	≤5.8	>5.8 and <7.2	≥7.2
65-74	≤6.7	>6.7 and <8.1	≥8.1	≤5.8	>5.8 and <7.2	≥7.2

* While elbow breadth calipers may not be readily available to clinicians, the elbow breadth can be measured with a ruler as described above.

Adapted from: Frisancho AR. New standards of weight and body composition by frame size and height for assessment of nutritional status of adults and the elderly. *Am J Clin Nutr.* 1984;40:808-819.

BODY FRAME SIZE BASED ON WRIST CIRCUMFERENCE IN RELATION TO HEIGHT

Measure the wrist circumference with a fiberglass tape measure; use the following chart by locating the row that corresponds to the pt's ht to determine frame size for each category of wrist circumference.

Gender	Height (inches/cm)	Wrist Measure (inches)	Wrist Measure (cm)	Classification
Women	Under 62"/158 cm	<5.5" 5.5" to 5.75" >5.75"	<14.0 cm 14.0-14.6 cm >14.6 cm	Small Medium Large
	62" to 65"/158-165 cm	<6" 6" to 6.25" >6.25"	<15.2 cm 15.2-15.9 cm >15.9 cm	Small Medium Large
	>65"/165 cm	<6.25" 6.25" to 6.5" >6.5"	<15.9 cm 15.9-16.5 cm >16.5 cm	Small Medium Large
Men	>65"/165 cm	5.5" to 6.5" >6.5" to 7.5" >7.5"	14.0-16.5 cm 16.5-19.1 cm >19.1 cm	Small Medium Large

Reference: Medline Plus. Calculating body frame size. http://oer2go.org/mods/en-medline_plus/ency/imagepages/17182.htm. Updated 8/22/08. Accessed 7/16/2020.

DETERMINATION OF FRAME SIZE BY WRIST CIRCUMFERENCE

Use a fiberglass tape to measure the circumference of the right (or non-access) wrist just beyond the wrist bone toward the hand. If the right wrist is swollen or enlarged for any reason, use the left wrist. Document which wrist is measured (for subsequent measurements) and record the measurement in cm.

$$\textbf{Frame Size} = \frac{\text{Ht}}{\text{Wrist circumference (cm)}}$$

CONVERSION TABLE

Males	Frame Size	Females
>10.5	Small	>11.0
9.6-10.5	Medium	10.1-11.0
<9.6	Large	<10.1

Reference: Grant JP. *Handbook of Parenteral Nutrition.* W.B. Saunders, Philadelphia; 1980.

Note: While this formula is widely cited, it has not been validated by the criterion of significant association with lean mass in a large sample of men and women/obese and non-obese individuals of varying ages.

METHODS TO DETERMINE BODY WEIGHTS

In adults with CKD 1-5D and posttransplantation, it is reasonable for the RDN or an international equivalent or physicians to use clinical judgment to determine the method for measuring BW (eg, actual measured wt; history of wt changes; serial wt measurements; adjustments for suspected impact of edema, ascites, and polycystic organs) due to absence of standard reference norms (OPINION).

Ideal BW (IBW)	BW that is associated with the lowest mortality for a given ht, age, gender, and frame size. This method is not generalizable to the CKD population, and data-gathering methods were not standardized. Based on the Metropolitan Life Insurance Ht and Wt tables
Ideal BW (Hamwi method)	♀ 100 lb (45.36 kg) for first 5'0" (127 cm) plus 5 lb (2.27 kg) for each additional inch (25.4 cm) above 5'0" ♂ 106 lb (48.08 kg) for first 5'0" (127 cm) plus 6 lb (2.72 kg) for each additional inch (25.4 cm) above 5'0" *Can subtract 10% for small frame and add 10% for large frame Quick and easy, but no data to support its use
Standard BW (SBW)	Average 50th percentile wts for men and women by age, ht, and frame size in the U.S. from 1976 to 1980 for ht, age, gender, and frame size. Data are validated, standardized, and use a large database of ethnically diverse groups, but data only provide what individuals weighed, not what they should weigh to reduce M/M (based on NHANES II data). This method was recommended in the KDOQI 2000 Nutrition Guideline
Desirable BW (DBW)	Based on BMI often defines generalized obesity in the general population. Studies in maintenance dialysis pt have suggested that pts with higher BMI have a lower mortality risk, but it is not clear that research has statistically adjusted for all confounders related to comorbid conditions in CKD on dialysis or how this M/M risk relates to pts not on dialysis
Adjusted BW (ABW)	ABW = IBW + [(ABW – IBW) × 0.25] based on the theory that only 25% of excess BW (fat) is metabolically active tissue. This has not been validated in CKD and when used to calculate energy and protein needs may either over- or underestimate those needs
Edema-free BW	Analogous to estimated DW in the pt being treated by renal replacement therapies
Percent of usual BW (UBW)	Percent UBW = (UBW – current BW)/ UBW) × 100. Percent change in UBW (DW for dialysis) may be a more reliable measure of risk for PEW than absolute BW or BMI

Reference: Ikizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.

STANDARD BODY WEIGHT

NHANES II – Average 50th percentile wts for men and women by age, ht, and frame size in the United States.

Note: Some categories are based on a small sample of pts or estimated with linear regression and may not be appropriate for an individual pt. Use clinical judgment in applying these SBWs since they represent what actual wts, not wts associated with lower M/M.

Male	25-54 yr			55-74 yr			Female	25-54 yr			55-74 yr		
Frame (Ht^{cm})	S	M	L	S	M	L	Frame (Ht^{cm})	S	M	L	S	M	L
157	64	68	82	61	68	77*	147	52	63	86	54	57	92
160	61	71	83	62	70	80	150	53	66	78	55	62	78
163	66	71	84	63	71	77	152	53	60	87	54	65	78
165	66	74	79	70	72	79	155	54	61	81	56	64	79
168	67	75	84	68	74	80	157	55	61	81	58	64	82
170	71	77	84	69	78	85	160	55	62	83	58	65	80
173	71	78	86	70	78	83	163	57	62	79	60	66	77
175	74	78	89	75	77	84	165	60	63	81	60	67	80
178	75	81	87	76	80	87	168	58	63	75	68	66	82
180	76	81	91	69	84	84	170	59	65	80	61*	72	80
183	74	84	91	76*	81	90	173	62	67	76	61*	70	79
185	79*	85	93	78*	88	88	175	63*	68	79	62*	72*	85*
188	80*	88	92	77*	95	89	178	64*	70	76	63*	73*	85*

* Estimated with linear regression formula.

Reference: Frisancho AR. New Standards of weight and body composition by frame size and height for assessment of nutritional status of adults and the elderly. *Am J Clin Nutr.* 1984;40:808-819.

DESIRABLE BODY WEIGHT BASED ON BODY MASS INDEX

Weight tables are not readily available for all cultures or nationalities, nor do the standard wt tables for the U.S. population provide appropriate wts for those from other countries or cultures. Desirable BW has been described as a BMI from 18.5 to 24.9 kg/m^2. Overweight is defined as a BMI of 25.0-29.9 kg/m^2, and obesity as a BMI of 30 kg/m^2 or greater. BMI is used in many countries to assess "desired" wt; thus, below are wts for BMI 20-25 and for BMI 23.6-24 kg/m^2 (associated with survival in HD pts). Clinicians should compare these ranges to the individual "normal" adult wt to determine a reasonable wt to use for nutrient prescription.

Height	Weight Range (kg)	Weight Range (kg)	Height	Weight Range (kg)	Weight Range (kg)
(in/cm)	**BMI 20-25**	**BMI 23-24**	**(in/cm)**	**BMI 20-25**	**BMI 23-24**
53/134.6	36.2-45.3	41.7-43.5	**66/167.6**	56.2-70.3	64.6-67.3
54/137.2	37.6-47.0	43.3-45.2	**67/170.2**	57.9-72.4	66.6-69.5
55/139.7	39.0-48.8	44.9-46.8	**68/172.7**	59.7-74.6	68.6-71.6
56/142.2	40.5-50.6	46.5-48.6	**69/175.3**	61.4-76.8	70.6-73.7
57/144.8	41.9-52.4	48.2-50.3	**70/177.8**	63.2-79.0	72.7-75.9
58/147.3	43.4-54.3	49.9-52.1	**71/180.3**	65.0-81.3	74.8-78.1
59/149.9	44.9-56.1	51.7-53.9	**72/182.9**	66.9-83.6	76.9-80.3
60/152.4	46.5-58.1	53.4-55.7	**73/185.4**	68.8-86.0	79.1-82.5
61/154.9	48.0-60.0	55.2-57.6	**74/188.0**	70.7-88.3	81.3-84.8
62/157.5	49.6-62.0	57.0-59.5	**75/190.5**	72.6-90.7	83.5-87.1
63/160.0	51.2-64.0	58.9-61.5	**76/193.0**	74.5-93.2	85.7-89.4
64/162.6	52.9-66.1	60.8-63.4	**77/195.6**	76.5-95.6	88.0-91.8
65/165.1	54.5-68.1	62.7-65.4	**78/198.1**	78.5-98.1	90.3-94.2

References: Kopple JD, Zhu X, Lew NL, Lowrie EG. Body weight for height relationships predict mortality in maintenance hemodialysis patients. *Kidney Int.* 1999.56:1136-1148.
Kopple JD, Massry SG, Kalantaar-Zedeh K, eds. *Nutritional Management of Renal Disease.* 3rd ed. New York: Elsevier Academic Press; 2013:446.

ADJUSTED BODY WEIGHT FOR THE OBESE OR UNDERWEIGHT PATIENT*

$$ABW = IBW + [(Actual\ BW - IBW) \times 0.25]$$

*Previous CKD Nutrition Guidelines suggested adjusting the wt when a pt's wt is <95% or >115% of SBW.[1] The 2020 CKD Nutrition Guideline workgroup suggests that the choice of BW should be based on clinical judgement related to patient's health goals.

The original published adjustment formula was developed for obese individuals[2] (>125% of IBW) with the concept that fatty tissue is less metabolically active than lean tissue, requiring different nutrient levels for wt maintenance. Nutrient recommendations, based on actual BW, are likely to overestimate needs, and those based on IBW might underestimate the needs of an obese individual. The traditional formula was not originally applied to underweight pts; however, nephrology dietitians have historically recommended nutrient levels based on ideal or desirable wt for underweight pts. ***Regardless of whether the wt is adjusted, clinicians must consider the appropriateness of the nutrient recommendations for each individual pt.***

References: [1] NKF DOQI Clinical practice guidelines for nutrition in CRF. *Am J Kidney Dis.* 2000;35:S1-S140.
[2] Karkeck J. Adjustment for obesity. *ADA Renal Practice Group Newsletter*. 1984;(Winter)3:6.

WAIST CIRCUMFERENCE (WC) AND WAIST-TO-HIP RATIO (WHR)

According to the NIH, a high WC is associated with an increased risk for type 2 diabetes, dyslipidemia, hypertension, and CVD when the BMI is between 25 and 34.9. WC can be useful for those people categorized as normal or overweight in terms of BMI. (Example: a muscular athlete may have a BMI greater than 25 [overweight on the BMI scale] but a WC measurement is unlikely to indicate that he/she is not overweight.) Changes in WC over time indicate an increase or decrease in abdominal fat. Increased abdominal fat is associated with an increased risk of heart disease.

*CKD: In adults with **CKD 5D**, we suggest that WC may be used to assess abdominal obesity, but its reliability in assessing changes over time is low (2C).*

WC Associated With Higher Risk for Disease

Men	>102 cm (>40 in)
Women	>88 cm (>35 in)

According to the NIH WC should be measured just above the hip bone after the pt has breathed out using a stretch-resistant tape. Measure the hip circumference around the widest portion of the buttocks, with the tape parallel to the floor.

Waist to Hip Ratio (WHR) = WC ÷ Hip Circumference

WHR Chart		
Male	**Female**	**Potential Health Risk**
0.95 or below	0.80 or below	Low risk
0.96 to 1.0	0.81 to 0.85	Moderate risk
≥1.0	≥0.85	High risk

References: NIH. Assessing Your Weight and Health Risk. https://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/risk.htm. Accessed 7/17/2020.
World Health Organization (WHO). *Waist Circumference and Waist-Hip Ratio. Report of a WHO Expert Consultation.* Geneva, Switzerland: WHO Press; 12/2008.
Ikizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.

CLINICAL SIGNS OF FLUID STATUS IN DIALYSIS PATIENTS

Fluid Overload	Dehydration
Gain >4% BW between treatments	Minimal wt gain/wt loss between treatments
Hypertension (onset or increase in BP)	Hypotension/orthostatic fall in blood pressure
Peripheral edema, ascites, pleural effusion	Collapsing veins/difficult venipuncture Cool extremities
Left ventricular failure with rales in lungs, labored breathing while supine, third heart sound	Decreased skin turgor
Dilution of the serum can cause some laboratory val-ues to be falsely low	Concentration of the serum can cause some laboratory values to be falsely high

USUAL FLUID INTAKE AND OUTPUT IN ADULTS WITHOUT KIDNEY DISEASE

Intake	Output
Fluid ingestion: about 1000-2000 cc/d (influenced by salt intake/ eating patterns)	Urine: normal 1000-2000 cc/d; varies to maintain fluid balance; decreases to negligible in CKD
Fluid from solid foods: 800-1000 cc/d	Perspiration: minimal except in hot climate Evaporation: 450 cc/d each from skin/respiration
Oxidative metabolism: 200-300 cc/d	Stool: approximately 100 cc/d

Reference: Kopple JD, Massry SG, Kalantaar-Zedeh K, eds. *Nutritional Management of Renal Disease.* 3rd ed. New York: Elsevier Academic Press; 2013.

WEIGHT COMPARISON FORMULAS

Percent SBW (% SBW)	$\frac{\text{Actual BW} \times 100}{\text{SBW}}$ (see page 1-31)
Percent DBW (% DBW)	$\frac{\text{Actual BW} \times 100}{\text{DBW}}$ (see page 1-32)
Percent UBW (% UBW)	$\frac{\text{Actual BW} \times 100}{\text{UBW}}$
Percent wt change (% wt change)	$\frac{(\text{Previous wt} - \text{actual wt}) \times 100}{\text{Previous wt}}$

Reference: Kopple JD, et al. A proposed glossary for dialysis kinetics. *Am J Kidney Dis.* 1995;26:963-981.

WEIGHT ESTIMATION IN AMPUTEES

To estimate the wt of persons with amputations for comparison to SBW (see page 1-31).
To estimate pre-amputation BW, increase post-amputation BW by the % listed for the amputated appendage(s).

Example: Post-amputation BW is 62.2 kg with 1 BK amputation
62.2 kg × 5.9% = 3.7 kg
62.2 kg +3.7 kg = 66.0 kg (Slight underestimation due to use of post-amputation BW to calculate % lost.)

To estimate the post-amputation BW, reduce pre-amputation BW by the % listed for the amputated appendage(s).

Example: Pre-amputation wt is 67 and the pt then has 1 BK amputation
67 kg × 5.9% = 3.9 kg 67 kg – 3.9 kg = 63

To estimate volume (V) change after amputation: Post-amputation BW × pre-amputation V/pre-amputation BW.

Example: Post-amputation BW = 62.6, pre-amputation V = 56, pre-amputation BW = 67
56/67 kg = 0.84
62.6 kg × 0.84 = 52.6 L (Assumes body water content does not change with amputation.)

Upper Body	% BW[1]	% BSA[2]	Lower Body	% BW[1]	% BSA[2]
Head, neck, trunk	50.0	—	Foot	1.5	3.5
Hand	0.7	2.5	Lower leg, below knee	5.9	10
Forearm + hand	2.3	6	Thigh	10.1	12.5
Entire arm	5.0	10	Entire leg	16.0	18

References: [1] *ADA Pocket Guide to Nutrition Assessment,* 2nd ed. Chicago: Academy of Nutrition and Dietetics; 2013.
[2] Tzamaloukas AH, Patron A, Malhotra D. Body mass index in amputees. *J Parenter Enteral Nutr.* 1994;18:355-358.

BODY MASS INDEX (BMI)

1. Standard Formula BMI = $\frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$ **2. Simplified BMI** = $\frac{\text{Weight (lbs)} \times 705}{\text{Height (in}^2\text{)}}$

Conversion to M^2						Conversion to In^2					
Height		M^2	Height		M^2	Height		In^2	Height		In^2
Feet	Cm		Feet	Cm		Inches	Feet		Inches	Feet	
4'9"	144.8	2.10	5'7"	170.2	2.90	57"	4'9"	3249	67"	5'7"	4489
4'10"	147.3	2.17	5'8"	172.7	2.98	58"	4'10"	3364	68"	5'8"	4624
4'11"	149.9	2.25	5'9"	175.3	3.07	59"	4'11"	3481	69"	5'9"	4761
5'0"	152.4	2.32	5'10"	177.8	3.16	60"	5'0"	3600	70"	5'10"	4900
5'1"	154.9	2.40	5'11"	180.3	3.25	61"	5'1"	3721	71"	5'11"	5041
5'2"	157.5	2.48	6'0"	182.9	3.35	62"	5'2"	3844	72"	6'0"	5184
5'3"	160.0	2.56	6'1"	185.4	3.44	63"	5'3"	3969	73"	6'1"	5329
5'4"	162.6	2.64	6'2"	188.0	3.53	64"	5'4"	4096	74"	6'2"	5476
5'5"	165.1	2.73	6'3"	190.5	3.63	65"	5'5"	4225	75"	6'3"	5625
5'6"	67.6	2.81	6'4"	193.0	3.73	66"	5'6"	4356	76"	6'4"	5776

Reference: Stensland SH, et al. Simplifying the calculation of BMI for quick reference. *J Am Dietetic Assoc.* 1990;90(6):856.

To calculate BMI of an amputee, determine "true" BW of the amputee, ie, wt without amputation. Calculate the wt of the amputated limb, then calculate the "true" BW of the amputee (see chart on page 1-37).

$\frac{100 \times \text{(present BW)}}{100 - \text{wt \% of amputated limb}}$

Male, 3/4 of leg amputated – Add the wt of the foot (1.37) and 3/4 the leg (0.75 × 4.33).
Weight percentage is 4.62%. Thus, a 165 lb man will lose 7.62 lb following a 3/4 leg amputation.

BMI CLASSIFICATIONS

BMI	Evaluation
<18.5	Underweight
18.5-24.9	Normal weight
25-29.9	Overweight
≥30	Obesity
KDOQI 2000	The upper 50th percentile of BMI (approximately 23.6 to 24.0) may be best for survival in CKD stage 5D pts. *Overweight/obese status may be used as a predictor of lower mortality in MHD*

Note: Although BMI can be used for most men and women, it may overestimate body fat in athletes/muscular build and may underestimate body fat in older persons and others who have lost muscle.

References: NIH. Calculate your body mass index. https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi-m.htm. Accessed 7/17/2020.
NKF DOQI clinical practice guidelines for nutrition in CRF. *Am J Kidney Dis.* 2000;35:S1-S140.

GENDER-SPECIFIC WEIGHT OF LIMB SEGMENTS AS A PERCENTAGE OF TOTAL BODY WEIGHT*

Gender	Upper Arm	Forearm	Hand	Thigh	Lower Leg	Foot
Female	2.55	1.38	0.56	14.78	4.81	1.29
Male	2.71	1.62	0.61	14.16	4.33	1.37

*Represents a statistical average.

Reference: DeLeva P. Adjustments to Zatsiorsky-Seluyanov's segment inertia parameters. *Journal of Biomechanics.* 1996;29:1223-1230.

CREATININE INDEX* (CI)
(estimates edema-free lean body mass)

Creatinine Kinetics: *1.1.15 In adults with* ***CKD 5D****, we suggest that creatinine kinetics may be used to estimate muscle mass, though very high or very low dietary intake of meat and/or creatine supplements will influence accuracy of this measurement (2C). The guideline for using creatinine kinetics to measure muscle mass applies to all adult CKD pts. However, the procedure requires the pt to collect his/her urine for a 24-hr period and, preferably, to keep the collection on ice, which may make the procedure inconvenient for some pts. In MHD pts, creatinine kinetics based on pre- and post-hemodialysis serum Cr measurements is more reliable for pts who are anuric.*

The CI is defined as the Cr synthesis or production rate and is used to assess skeletal muscle mass. It is determined by the size of the skeletal muscle mass as well as the intake of creatine and Cr. Cr production is approximately proportional to skeletal muscle mass in metabolically stable adults who have consistent protein intake. In CKD 5D pts, Cr is synthesized, and serum levels rise at a rate that is approximately proportional to somatic protein mass and dietary protein intake. The CI is measured as the sum of Cr removed from the body (urine, dialysate, ultrafiltrate), any increase in the body Cr pool, and the Cr degradation rate.

***CI:** mg/24 hr = dialysate (ultrafiltrate) Cr mg/24 hr + urine Cr mg/24 hr + change in Cr body pool mg/24 hr + Cr degradation mg/24 hr

Change in body Cr pool mg/24 hr = (final serum Cr mg/L - initial serum Cr) × (24 hr/time interval between Cr measurements) × (BW kg × 0.5 L/kg)

If BW is variable:

Change in body Cr pool mg/24 hr = [final serum Cr mg/L × (final BW kg × 0.5 L/kg)] - [initial serum Cr mg/L × (initial BW kg × 0.5 L/kg)] × (24 hr/time interval between Cr measurements)

Cr degradation (gut) mg/24 hr = 0.038 dL/kg/24 hr × serum Cr mg/dL × BW kg

Edema-free LBM kg = 0.029 kg/mg/24 hr × CI mg/24 hr + 7.38 kg

*CI or total Cr production = Cr excretion + Cr degradation.

References: NKF DOQI Clinical practice guidelines for nutrition in CRF. *Am J Kidney Dis.* 2000;35:S1-S140.
Ikizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.

BODY SURFACE AREA

BSA is a better indicator of metabolic mass than BW, because it is less affected by abnormal adipose tissue. BSA is used to determine certain medical measures and medication dosing. For example, kidney function is measured by the GFR, which is calculated in relation to the BSA. While previous editions of the Pocket Guide had formulas and a nomogram for calculation of BSA, most laboratories calculate the BSA as needed for various tests. Additionally, there are many sites for calculation on the Internet; thus, we eliminated the 2 pages dedicated to BSA in this revision.

https://www.gigacalculator.com/calculators/bsa-calculator.php

https://www.calculator.net/body-surface-area-calculator.htm

https://www.mdcalc.com/body-mass-index-bmi-body-surface-area-bsa

References: Georgiev G.Z., *"Body Surface Area Calculator"*. https://www.gigacalculator.com/calculators/bsa-calculator.php. Accessed:7/17/2020.
Calculator.net. Body Surface Area Calculator. https://www.calculator.net/body-surface-area-calculator.htm. Accessed 7/17/2020.
MD+CALC. Body Mass Index and Body Surface Area. https://www.mdcalc.com/body-mass-index-bmi-body-surface-area-bsa. Accessed 7/17/2020.

TOTAL BODY WATER

Method	Gender	Formula
Watson[1]	Male	V (liters) = 2.447 + 0.3362 * wt (kg) + 0.1074 * ht (cm) - 0.09516 * age (yr)
	Female	V = -2.097 + 0.2466 * wt + 0.1069 * ht
Hume[2]	Male	V = -14.012934 + 0.296785 * wt + 0.194786 * ht
	Female	V = -35.270121 + 0.183809 * wt + 0.344547 * ht
Mellits-Cheek[3]	Male	V (liters) = -1.927 + 0.465 * wt (kg) + 0.045 * ht (cm), when ht ≤ 132.7 cm V = -21.993 + 0.406 * wt + 0.209 * ht, when ht ≥ 132.7 cm
	Female	V = 0.076 + 0.507 * wt + 0.013 * ht, when ht ≤ 110.8 cm V = -10.313 + 0.252 * wt + 0.154 * ht, when ht ≥ 110.8 cm
Urea Volume[4]	Male	(2.447 + 0.3362 * wt + 0.1074 * ht – 0.09516 * age) (* gender * diabetes * race)
	Female	(-2.097 + 0.2466 * wt + 0.1069 * ht) (* gender * diabetes * race)
		Corrections: Gender * 0.824 * 0.998 (age 50) if male * 0.824 * 0.985 (age 50) * 1.033 if female Diabetic * 1.033 if diabetic Race *1.043 if Black

References: [1] Watson PE, Watson ID, Batt RD. Total body water volumes for adult males and females estimated from simple anthropometric measurements. *Am J Clin Nutr.* 1980;33:27-39.
[2] Hume R, Weyers E. Relationship between TBW and surface area in normal and obese subjects. *J Clin Pathol.* 1971;24:234-238.
[3] Mellits ED, Cheek DB. The assessment of body water and fatness from infancy to adulthood. *Soc Res Child Dev.* 1970;35:12-26.
[4] Daugirdas JT, et al. Anthropometrically estimated TBW are larger than urea volume in chronic HD patients. *Kidney Int.* 2004;64:1108-1119.

SKINFOLD MEASUREMENTS/ARM ANTHROPOMETRICS

The guideline for skinfold measurements apply to all adult CKD pts, including posttransplantation. However, longitudinal assessments are most useful for the practitioner to enable identification of changes in percent body fat for individual pts. The accuracy of skinfold measurements may be compromised in obese pts due to the limitation of the calipers to accommodate high level of adiposity. Good-quality calipers are needed to obtain an accurate measurement of skinfold and the measurer must be trained for accurate results.

Step 1: Mid-arm Circumference (MAC)

1. With the pt standing (if possible) and at DW, measure the circumference of the pt's right or non-access arm using a fiberglass tape.
2. For the maximum accuracy, place the pt's forearm across the stomach, measure and mark the midpoint between the acromial and olecranon processes.
3. Have the pt relax the arm at his or her side and measure the arm circumference at the mark without compressing the soft tissue. Record to the nearest 0.1 cm.

Step 2: Triceps Skinfold (TSF)

1. With the pt's arm relaxed at his or her side, pick up or lightly pinch a lengthwise double fold of skin with a thumb and forefinger just above the marked midpoint. Have the pt open and close the fist to ensure that none of the muscle is included in the pinch.

   Note: It may be easiest to start the pinch below the midpoint and work the fingers up to the mark.
2. Hold the calipers parallel to the floor, place them over the fat fold at the mark, to a depth approximately equal to the width of the fat fold. Release calipers while holding the pinch and take the reading within 3 sec. Repeat 3 times and record the average.

Step 3: Mid-arm Muscle Circumference (MAMC) Calculate as follows: MAMC = MAC - (TSF × 0.314).

Step 4: Mid-upper Arm Muscle Area (MAMA) Calculate as follows: MAMA = $(MAMC)^2/12.56$.

Step 5: Evaluation

1. Compare values to reference standards and record the percent of standard (see pages 1-44 to 1-48).
2. Use the pt as his or her own standard in subsequent measurements.

Note: Measurements on a significant HD population showed few differences from the NHANES II norms, although the study did not meet criteria to be included as evidence in the Clinical Practice Guidelines for Nutrition in CKD: 2020 Update.

References: Nelson E. Anthropometry in the nutritional assessment of adults with end-stage renal disease. *J Ren Nutr.* 1991;1:162-172.
kizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.

REFERENCE VALUES FOR THE TRICEPS SKINFOLD THICKNESS (mm) – MALE

Age Group	Percentile								
(yr)	5	10	15	25	50	75	85	90	95
15.0-15.9	5.0	5.0	5.0	6.0	7.5	11.0	15.0	18.0	23.5
16.0-16.9	4.0	4.0	5.1	6.0	8.0	12.0	14.0	17.0	23.0
17.0-17.9	4.0	4.0	5.0	6.0	7.0	11.0	13.5	16.0	19.5
18.0-24.9	4.0	4.0	5.5	6.5	10.0	14.5	17.5	20.0	23.5
25.0-29.9	4.0	4.0	6.0	7.0	11.0	15.5	19.0	21.5	25.0
30.0-34.9	4.5	4.5	6.5	8.0	12.0	16.5	20.0	22.0	25.0
35.0-39.9	4.5	4.5	7.0	8.5	12.0	16.0	18.5	20.5	24.5
40.0-44.9	5.0	5.0	6.9	8.0	12.0	16.0	19.0	21.5	26.0
45.0-49.9	5.0	5.0	7.0	8.0	12.0	16.0	19.0	21.0	25.0
50.0-54.9	5.0	5.0	7.0	8.0	11.5	15.0	18.5	20.8	25.0
55.0-59.9	5.0	5.0	6.5	8.0	11.5	15.0	18.0	20.5	25.0
60.0-64.9	5.0	5.0	7.0	8.0	11.5	15.5	18.5	20.5	24.0
65.0-69.9	4.5	4.5	6.5	8.0	11.0	15.0	18.0	20.0	23.5
70.0-74.9	4.5	4.5	6.5	8.0	11.0	15.0	17.0	19.0	23.0

Adapted from: Frisancho AR. *Anthropometric Standards for the Assessment of Growth and Nutritional Status.* MI: U Mich Press; 1993.

REFERENCE VALUES FOR THE TRICEPS SKINFOLD THICKNESS (mm) – FEMALE

Age Group	Percentile								
(yr)	5	10	15	25	50	75	85	90	95
15.0-15.9	8.0	9.5	10.5	12.0	16.5	20.5	23.0	26.0	32.5
16.0-16.9	10.5	11.5	12.0	14.0	18.0	23.0	26.0	29.0	32.5
17.0-17.9	9.0	10.0	12.0	13.0	18.0	24.0	26.5	29.0	34.5
18.0-24.9	9.0	11.0	12.0	14.0	18.5	24.5	28.5	31.0	36.0
25.0-29.9	10.0	12.0	13.0	15.0	20.0	26.5	31.0	34.0	38.0
30.0-34.9	10.5	13.0	15.0	17.0	22.5	29.5	33.0	35.5	41.5
35.0-39.9	11.0	13.0	15.5	18.0	23.5	30.0	35.0	37.0	41.0
40.0-44.9	12.0	14.0	16.0	19.0	24.5	30.5	35.0	37.0	41.0
45.0-49.9	12.0	14.5	16.5	19.5	25.5	32.0	35.5	38.0	42.5
50.0-54.9	12.0	15.0	17.5	20.5	25.5	32.0	36.0	38.5	42.0
55.0-59.9	12.0	15.0	17.0	20.5	26.0	32.0	36.0	39.0	42.5
60.0-64.9	12.5	16.0	17.5	20.5	26.0	32.0	35.5	38.0	42.5
65.0-69.9	12.0	14.5	16.0	19.0	25.0	30.0	33.5	36.0	40.0
70.0-74.9	11.0	13.5	15.5	18.0	24.0	29.5	32.0	35.0	38.5

Adapted from: Frisancho AR. *Anthropometric Standards for the Assessment of Growth and Nutritional Status.* MI: U Mich Press; 1993.

REFERENCE VALUES FOR MID-ARM MUSCLE CIRCUMFERENCE (cm)

Age Group		Percentile						
(yr)		5	10	25	50	75	90	95
Male	**18-24**	23.5	24.4	25.8	27.2	28.9	30.8	32.3
	25-34	24.2	25.3	26.5	28.0	30.0	31.7	32.9
	35-44	25.0	25.6	27.1	28.7	30.3	32.1	33.0
	45-54	24.0	24.9	26.5	28.1	29.8	31.5	32.6
	55-64	22.8	24.4	26.2	27.9	29.6	31.0	31.8
	65-74	22.5	23.7	25.3	26.9	28.5	29.9	30.7
Female	**18-24**	17.7	18.5	19.4	20.6	22.1	23.6	24.9
	25-34	18.3	18.9	20.0	21.4	22.9	24.9	26.6
	35-44	18.3	19.2	20.6	22.0	24.0	26.1	27.4
	45-54	18.8	19.5	20.7	22.2	24.3	26.6	27.8
	55-64	18.6	19.5	20.8	22.6	24.4	26.3	28.1
	65-74	18.6	19.5	20.8	22.5	24.4	26.5	28.1

Reference: Bishop CW, et al. Norms for nutritional assessment of American adults by upper arm anthropometry. *Am J of Clin Nutr.* 1982;34:347.

REFERENCE VALUES FOR MID-UPPER ARM MUSCLE AREA (cm) – MALE

Age Group	Percentile								
(yr)	5	10	15	25	50	75	85	90	95
15.0-15.9	31.9	34.9	36.9	40.3	46.3	53.1	56.3	65.7	63.0
16.0-16.9	37.0	40.9	42.4	45.9	51.9	57.8	63.6	66.2	70.5
17.0-17.9	39.6	42.6	44.8	48.0	53.4	60.4	64.3	67.9	73.1
18.0-24.9	34.2	37.3	39.6	42.7	49.4	57.1	61.8	65.0	72.0
25.0-29.9	36.6	39.9	42.4	46.0	53.0	61.4	66.1	68.9	74.5
30.0-34.9	37.9	40.9	43.4	47.3	54.4	63.2	67.6	70.8	76.1
35.0-39.9	38.5	42.6	44.6	47.9	55.3	64.0	69.1	72.7	77.6
40.0-44.9	38.4	42.1	45.1	48.7	56.0	64.0	68.5	71.6	77.0
45.0-49.9	37.7	41.3	43.7	47.9	55.2	63.3	68.4	72.2	76.2
50.0-54.9	36.0	40.0	42.7	46.6	54.0	62.7	67.0	70.4	77.4
55.0-59.9	36.5	40.8	42.7	46.7	54.3	61.9	66.4	69.6	75.1
60.0-64.9	34.5	38.7	41.2	44.9	52.1	60.0	64.8	67.5	71.6
65.0-69.9	31.4	35.8	38.4	42.3	49.1	57.3	61.2	64.3	69.4
70.0-74.9	29.7	33.8	36.1	40.2	47.0	54.6	59.1	62.1	67.3

Adapted from: Frisancho AR. *Anthropometric Standards for the Assessment of Growth and Nutritional Status.* MI: U Mich Press; 1993.

REFERENCE VALUES FOR MID-UPPER ARM MUSCLE AREA (cm) – FEMALE

Age Group	Percentile								
(yr)	5	10	15	25	50	75	85	90	95
15.0-15.9	24.4	25.8	27.5	29.2	33.0	37.3	40.2	41.7	45.9
16.0-16.9	25.2	26.8	28.2	30.0	33.6	38.0	40.2	43.7	48.2
17.0-17.9	25.9	27.5	28.9	30.7	34.3	39.6	43.4	46.2	50.8
18.0-24.9	19.5	21.5	22.8	24.5	28.3	33.1	36.4	39.0	44.2
25.0-29.9	20.5	21.9	23.1	25.2	29.4	34.9	38.5	41.9	47.8
30.0-34.9	21.1	23.0	24.2	26.3	30.9	36.8	41.2	44.7	51.3
35.0-39.9	21.1	23.4	24.7	27.3	31.8	38.7	43.1	46.1	54.2
40.0-44.9	21.3	23.4	25.5	27.5	32.3	39.8	45.8	49.5	55.8
45.0-49.9	21.6	23.1	24.8	27.4	32.5	39.5	44.7	48.4	56.1
50.0-54.9	22.2	24.6	25.7	28.3	33.4	40.4	46.1	49.6	55.6
55.0-59.9	22.8	24.8	26.5	28.7	34.7	42.3	47.3	52.1	58.8
60.0-64.9	22.4	24.5	26.3	29.2	34.5	41.1	45.6	49.1	55.1
65.0-69.9	21.9	24.5	26.2	28.9	36.6	41.6	46.3	49.6	56.5
70.0-74.9	22.2	24.4	26.0	28.8	34.3	41.8	46.4	49.2	54.6

Adapted from: Frisancho AR. *Anthropometric Standards for the Assessment of Growth and Nutritional Status.* MI: U Mich Press; 1993.

OTHER MEASURES OF BODY COMPOSITION

Methods	Guideline Statement	Assesses	Advantages	Limitations
DXA	In adults, CKD 1-5D and posttransplantation it is reasonable to use DXA when feasible as it remains the gold standard for measuring body composition despite being influenced by volume status (Opinion)	Bone/bone mineral content, fat mass, and LBM	Validated high precision/ pt acceptance, low radiation, can provide localized body comp, suitable for all ages	Affected by hydration, tissue density, assumption re: soft tissue content near bone, cost, inconvenience
Hydrodensitometry (underwater weighing)		LBM	Most accurate in CKD if combined with DXA and volume of TBW	Difficult for pt (submersion/exhaling air from lungs), special equipment
BIA (multifrequency preferred)	Suggested for MHD performed at least 30 min after dialysis to allow for volume redistribution, but not enough evidence for use in CKD 1-5 or PD	TBW, LBM, fat mass	Easy to perform, time efficient, high pt acceptance, little training needed, portable	*May not distinguish between changes in LBM vs. hydration status. May be more useful in populations rather than individuals*
Near infrared interactance radiation (NIR)	Evidence of validity was too limited to make recommendations	Body composition, % body fat	Not influenced by state of hydration, consistent measurements, ease	Limited research in dialysis pts

References: Ikizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.
DeVita MV, Stall S. Dual-energy x-ray absorptiometry: a review. *J Ren Nutr.* 1999;9:178-181.
Kopple JD, Massry SG, eds. *Nutritional Management of Renal Disease,* 2nd ed. Philadelphia: Williams & Wilkins; 2004.
Stall S, et al. BIA and DEXA to monitor nutritional status. Perit Dial Int. 1995;15(suppl):S-62.

COMPOSITE NUTRITION INDICIES: SUBJECTIVE GLOBAL ASSESSMENT (SGA)

*In adults with **CKD 5D,** we recommend the use of the 7-point SGA as a valid and reliable tool for assessing nutritional status (1B).*

In adults with CKD on MHD and posttransplantation, MIS may be used to assess nutritional status (2C).

SGA is the overall evaluation by an experienced clinician of the history and physical exam to rate pts as well nourished, mild-to-moderately malnourished, or severely malnourished. The original use of SGA was to determine which pts were at risk of complications after GI surgery. The focus of SGA is nutrient intake and body composition. Both the KDOQI practice guidelines for peritoneal dialysis adequacy and nutrition recommend SGA as a valid and clinically useful measure of protein-energy status in CKD stage 5D pts. The CPG NUTRITION recommends the 7-point scale (in place of the A-B-C ratings used in the traditional SGA and pt-generated SGA; see pages 1-52 to 1-54.) with ratings of 1 to 2 indicating severe malnutrition, 3-4-5 moderate-to-mild malnutrition, and 6-7 well nourished. It uses only 4 of the main categories from the traditional SGA: wt change, dietary intake, and GI symptoms (anorexia, N/V, and diarrhea), loss of subcutaneous fat, and loss of muscle tissue.

SGA is subjective, based on the clinician's expertise and experience. Thus, the following ratings are only suggestions.

Training and agreement among team members will minimize inter-rater variability. A 1-page rating form can be used to record observations and the overall rating. The final rating is not an average of the individual category ratings, but a subjective rating by the clinician. Several rating forms have been published for use/adaptation.

References: Detsky AS, Baker JP, O'Rourke K, et al. Predicting nutrition-associated complications for patients undergoing GI surgery. *J Parenter Enteral Nutr.* 1987;11:440-446.
McCann L. Subjective global assessment as it pertains to the nutritional status of dialysis patients. *Dialysis & Transplantation.* 1996;25:190.
SGA Tutorial. https://sga.thinkific.com/courses/subjective-global-assessment. Accessed 7/6/2020.
Ikizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.
Fontes D, Generoso Sde V, Toulson Davisson Correia MI. Subjective global assessment: a reliable nutritional assessment tool to predict outcomes in critically ill patients. Clin Nutr. 2014;33:291-295.
Canadian Malnutrition Task Force. SGA-Diagnosing Malnutritionhttps://nutritioncareincanada.ca/resources-and-tools/hospital-care-inpac/assessment-sga. Accessed 7/17/2020.

AUTHOR'S NOTE ON SGA

SGA[1] in the CKD population creates a challenge: maintaining the subjectivity of the tool while maximizing inter-rater reliability. SGA is a simple, inexpensive tool that can add a perspective beyond the traditional objective measures of nutritional status. SGA has demonstrated its value as a standalone assessment technique in both PD and HD pts[2,3], as well as many other pt groups. While retaining the subjectivity of SGA is important, the following tips may be helpful:

1. Training and a review of technique with colleagues who will be assessing common pts are invaluable.
2. Dietary intake can be the most important early indicator of nutritional risk. Thus, an estimate of current intake compared to recommended nutrient levels (considering the duration of deficit or excess) is a worthwhile part of SGA.
3. Patterns of muscle wasting, or preservation may be inconsistent, depending on the physical activity/abilities of the pt.
4. Patient perspective and insight can be helpful in all aspects of SGA.
5. Evaluate tissue loss in relation to wt changes, especially in the baseline assessment.
6. Elderly pts typically have age-related tissue losses that mimic malnutrition. Get the pt's perspective.
7. With advance planning and instruction, it is possible to observe most or all the muscle/fat sites toward the end of dialysis (at or close to DW) treatment without compromising the pt's privacy. Use universal precautions.
8. Most pts can complete a simple questionnaire to provide some of the information needed for SGA.

References: [1] McCann L. Subjective global assessment as it pertains to the nutritional status of dialysis patients. *Dialysis & Transplantation.* 1996;25:190.
[2] Canada-USA (CANUSA) Peritoneal Dialysis Study Group. Adequacy of dialysis and nutrition in continuous peritoneal dialysis: association with clinical outcomes. *J Am Soc Nephrol.* 1996;7:198-207.
[3] Steiber A, Leon JB, Secker D, et al. Multicenter study of the validity and reliability of subjective global assessment in the hemodialysis population. *J Ren Nutr.* 2007;17:336-342.

SGA WEIGHT/MEDICAL/NUTRITION HISTORY

Use of standard questions can help improve the accuracy and consistency of the medical history portion of the SGA. It can also minimize the time it takes to gather pertinent information from the pt. Some or most of the information might also be obtained using a simple, pt-completed questionnaire.

Weight Changes
Usual adult wt? Current wt?
Weight 6 mo ago?
Weight 2 wk ago?
Any signs of fluid overload? Edema, SOB, HTN? (Important to the evaluation of wt change in CKD.)

Current Appetite/Intake
Is intake adequate to meet needs and recommendations?
Change in previous 6 mo?
Change in past 2 wk?

GI Distress
Anorexia—frequency/duration of anorexia?
Nausea—frequency/duration of nausea?
Vomiting—frequency/duration of vomiting?
Diarrhea—frequency/duration of diarrhea?

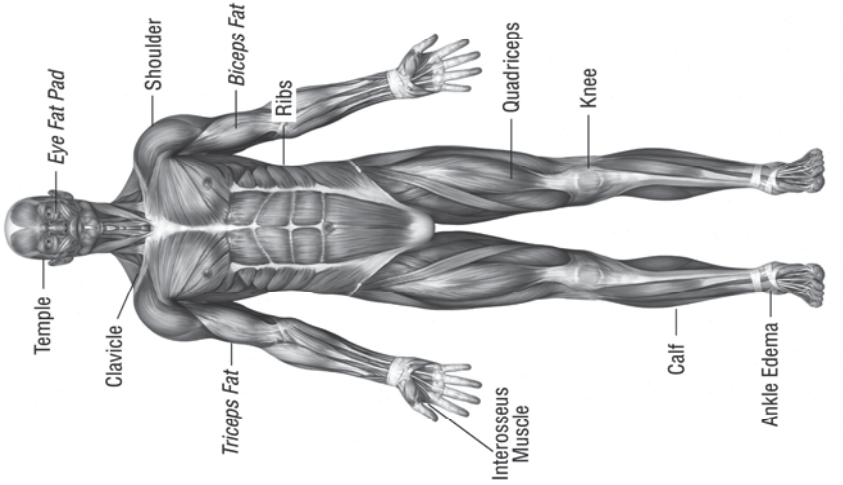
Function
Changes in function or activity related to malnutrition? (Activities of daily living, gardening, volunteer work, household chores, energy levels, etc.)

Metabolic Stress
Significant metabolic stress other than CKD? (Fever–degrees above normal and duration; use of steroids–dose dependent, significant infection, etc.)

References: McCann L. Subjective global assessment as it pertains to the nutritional status of dialysis patients. *Dialysis & Transplantation.* 1996;25:190.

SCHEMATIC OF MUSCLE TO GUIDE ASSESSMENT OF WASTING

(Fat store sites are in italics.)



References: McCann L. Subjective global assessment as it pertains to the nutritional status of dialysis patients. *Dialysis & Transplantation*. 1996;25:190.
McCann L., personal correspondence.

SGA PART I

Review medical record/use specific, detailed questions to assess status.

Weight

1. Weight change over 6 mo (Use rating as listed even in obese pts.)
   a. <5% = 6 or 7 (A)
   b. 5-10% = 3 or 4 or 5 (B)
   c. >10% and sustained loss = 1 or 2 (C)
   d. 10% but recovery to 5-10% = 3-4-5 (B)
   e. Sustained improvement = 1 level up from previous
2. Weight change over previous 2 wk
   a. No change, normal wt = 6 or 7 (A)
   b. Increasing or increased = rate 1 level up from previous rating
   c. Decreasing = rate 1 level below previous rating

Dietary Intake

1. Change in intake (duration and degree)
2. Base ratings on current and prior status
   a. Intake adequate for needs, no change or change is slight/short duration = 6 or 7 (A)
   b. Borderline, decreasing = 3 or 4 or 5 (B)
   c. Unable to eat, starvation = 1 or 2 (C)

GI Symptoms

1. N/V, diarrhea, anorexia
2. Duration and frequency
   a. Symptoms >2 wk, almost daily = 1 or 2 (C)
   b. Minor or no symptoms, occasional = 6 or 7 (A)
   c. Degree and frequency of symptoms between 3 or 4 or 5 (B)

Functional Status

1. Decreased strength or stamina due to malnutrition (see page 1-52 for examples)
2. Duration and degree of dysfunction (rate in relation to normal or previous SGA rating)

Metabolic Stress Comorbidities

1. Low-moderate (infection, skeletal trauma, malignancy)
2. High stress (ulcerative colitis with diarrhea)

SGA PART II

Physical Exam (Use universal precautions/protective hand washing.)

Exam Area	Tips	Level of Malnutrition		
		Severe	**Mild-Moderate**	**Well Nourished**
Subcutaneous fat		**1 or 2 (C)**	**3 or 4 or 5 (B)**	**6 or 7 (A)**
Below the eye	View pt straight on, touch above cheek bone with permission	Hollow look, depressions, dark circles, loose skin	Slightly dark circles, somewhat hollow look	Slightly bulged fat pads, fluid may mask loss
Triceps/biceps	Arm bent, roll skin between fingers, do not include muscle in pinch	Very little space between folds fingers touch	Some depth to pinch, but not ample	Ample fat tissue obvious between folds of skin
Muscle wasting				
Temple	Observe straight on, turn head side to side	Hollowing, scooping, indentation	Slight depression/ indentation	Can see/feel well-defined muscle
Clavicle	Look for prominent bone; make sure pt is not hunched forward	Protruding, prominent bone	Visible in male, some protrusion in female	Not visible in male, visible but not prominent in female
Shoulder	Arms at side, note shape	Shoulder to arm joint looks square	Acromion process may protrude slightly	Rounded, curves at arm/ shoulder/neck

SGA PART II (cont.)

Exam Area	Tips	Level of Malnutrition		
		Severe	**Mild-Moderate**	**Well Nourished**
Muscle (cont.)		**1 or 2 (C)**	**3 or 4 or 5 (B)**	**6 or 7 (A)**
Scapula	Have pt extend hands straight out, push against solid object	Prominent bone, depressions between ribs/ scapula, shoulder/spine	Mild depression, or bone may show slightly	Bones not prominent, no significant depressions
Interosseous muscle	Thumb side of hand; pads of thumb/forefinger touching	Depressed area between thumb/forefinger	Slightly depressed	Muscle bulges, could be flat in well-nourished person
Knee	Have pt sit, leg propped up, bent at knee	Bones prominent, scant knee muscle	Kneecap less bony, more rounded	Muscle protrudes, bones not prominent
Quadriceps	Not as sensitive as upper body	Depression/line on thigh, between groin and knee	Mild depression on inner thigh	Well rounded, developed
Calf	Observe side and front view	Thin, minimal/no muscle definition	Not well developed	Well-developed bulb of muscle
Edema - In dialysis, edema is important for quantifying wt loss in view of fluctuating fluid balance.				
R/O other edema causes, pt at DW	View sacrum in activity-restricted/ankles in mobile	Significant swelling	Mild-to-moderate swelling	No sign of fluid accumulation

Note: Upper body changes occur more quickly than lower body changes.
Reference: McCann L. Subjective global assessment as it pertains to the nutritional status of dialysis patients. *Dialysis & Transplantation.* 1996;25:190.

ESTIMATION OF PERFORMANCE OR FUNCTIONAL STATUS

The scale below is a guide to the assessment of a pt's functional status. During SGA, look for changes that are related to malnutrition (difficulty with ambulation secondary to muscle wasting). In the general assessment of renal pts, look for changes that are related to CKD and nutrition.

In CKD, compare functional status prior to kidney disease/dialysis in initial assessment or at last SGA to their current functional status.

Grade	Scale	SGA Score
0	Fully active, able to carry on all pre-disease performance without restriction; fully capable of hard work (Karnofsky 90-100)	7
1	Restricted in physically strenuous activity, but ambulatory and able to carry out light or sedentary type activities (office) (Karnofsky 70-80)	6-5
2	Ambulatory and capable of all self-care, but unable to work; up and about >50% of waking hours (Karnofsky 50-60)	4-3
3	Capable of only limited self-care, confined to bed or chair more than 50% of waking hours (Karnofsky 30-40)	2
4	Completely disabled, confined to bed or chair, no self-care (Karnofsky 10-20)	1

References: Campbell KL, Bauer JD, Ikehiro A, Johnson DW. Role of nutrition impact symptoms in predicting nutritional status and clinical outcome in hemodialysis patients: a potential screening tool. *J Ren Nutr.* 2013;23:302-307.
Desbrow B, Bauer J, Blum C, et al. Assessment of nutritional status in hemodialysis patients using subjective global assessment. *J Ren Nutr.* 2005;15:211-216.
Ottery FD. Patient-generated subjective global assessment. In: McCallum PD, Polisena CG, eds. *The Clinical Guide to Oncology Nutrition.* Chicago: The American Dietetic Association;2000:11-23.
PG-SGA forms. https://www.accc-cancer.org/docs/Documents/oncology-issues/supplements/scored-patient-generated-subjective-global-assessment-pg-sga. Published 2005. Accessed 12/15/2020.
Stanley KE. Prognosis factors for survival in patients with inoperable lung cancer. *J Natl Cancer Inst.* 1980;65:25-29.

PG-SGA RATINGS

Some countries/geographical areas have adopted the PG scored PG-SGA, which was initially developed to assess nutrition status for those with cancer. There are also abridged and short-form tools available. PG-SGA is designed to have the pt provide the medical history (about his/her wt, nutrient intake, GI symptoms, functionality, and comorbid conditions) using a check box format. The physical exam is then performed by a health professional with a final global rating of: A, well-nourished; B, mild to moderately malnourished; C, severely malnourished. Global rating of traditional SGA and PG-SGA may be similar. However, the scored PG-SGA is an additional modification that incorporates a numerical score of medical history components (points of 0-4, depending on the impact of the component on nutritional status.) The total score guides the level of nutrition intervention and facilitates collection of quantitative outcome data. A higher score indicates greater risk for malnutrition. A score of ≤9 indicates a critical need for intervention. Interventions are triaged from education to symptom management to nutrition support. As shown in the table below, it has been suggested that the "nutritional impact" of symptoms should be considered.

Characteristics of PG-SGA Ratings

A – Well Nourished	B – Moderately Well Nourished or Suspected Malnutrition	C – Severely Malnourished
No wt loss	5% wt loss within 1 mo or 10% loss in 6 mo; continued loss without stabilization/gain	>5% wt loss in 1 mo or >10% wt loss in 6 mo with no stabilization or gain
No deficit in intake/recent increase	Definite decreased intake	Severe deficit in intake
Symptoms have no impact or recent improvement allowing adequate intake	Presence of nutrition impact symptoms	Presence of nutrition impact symptoms
No deficit in function/recent gain	Moderate functional deficit/recent decline	Severe functional deficit/recent decline
No deficit on physical exam or chronic deficits have shown recent clinical improvements	Evidence of mild-to-moderate loss of subcutaneous fat and/or muscle mass and/or muscle tone on palpation	Obvious signs of malnutrition (severe muscle loss, loss of subcutaneous fat, possible edema)

Adapted from: Ottery FD. Patient-generated SGA. In: McCallum PD, Polisena CG, eds. *The Clinical Guide to Oncology Nutrition.* Chicago: ADA; 2000:11-23.
PG-SGA forms. https://www.accc-cancer.org/docs/documents/oncology-issues/supplements/scored-patient-generated-subjective-global-assessment-pg-sga.pdf. Published 2005. Accessed 7/17/2020.
Campbell K, et al. Role of nutrition impact symptoms in predicting nutritional status and clinical outcome in HD patients: a potential screening tool. JREN, 2013; 23(4)302-307. https://pubmed.ncbi.nlm.nih.gov/23026502 Accessed 7/7/2020.

MALNUTRITION INFLAMMATION SCORE (MIS)

*In adults with **CKD 5D on MHD and posttransplantation,** Malnutrition Inflammation Score may be used to assess nutritional status (2C).*

In moderate to severe CKD protein-energy wasting and inflammation, together also known as the malnutrition-inflammation-cachexia syndrome, are the strongest predictors of mortality and signal the urgent need for comprehensive but practical nutrition assessment tools. The MIS is a practical, low-cost tool to assess the nutritional status of pts with CKD and is a useful metric for risk stratification in MHD. The MIS can predict 5-yr mortality in MHD. Controlled trials of nutrition and anti-inflammatory interventions that can improve MIS are needed to examine the potential of improvement in CKD survival. Component of the score is classified according to 4 levels of severity, ranging from 0 (normal) to 3 (severely abnormal). The sum of 10 MIS components ranges from 0 (normal) to 30 (severe degree of malnutrition and inflammation).

Components of the Comprehensive MIS

Part A: Patient's Related Medical History Change in end dialysis DW (overall change in past 3-6 mo Dietary intake GI symptoms Functional capacity (nutrition-related impairment) MCC including the number of years on dialysis, CHF class III or IV, full-blown AIDS, severe CAD, metastatic malignancies/recent chemotherapy, major neurological sequela, moderate to severe COPD
Part B: Physical Exam (according to SGA criteria) Decreased fat stores or loss of subcutaneous fat (below eyes, biceps, triceps, chest) Signs of muscle wasting (temple, clavicle, scapula, ribs, quadriceps, interosseous)
Part C: Body Mass Index (BMI = wt(kg)/ht (m^2)
Part D: Laboratory Parameters Serum albumin Serum TIBC
Total Score is the sum of all scores from the 10 components above, each ranked from 0 to 3, depending on the degree of severity/ abnormality (4 ranking levels with 0 as normal to 3 as severely abnormal)

COMPREHENSIVE MALNUTRITION INFLAMMATION SCORE

A: PATIENT'S RELATED MEDICAL HISTORY			
1. Change in end dialysis DW/overall change in past 3-6 mo			
0 No DW ↓ /wt loss < 0.5 kg	1 Minor loss (> 0.5 but < 1 kg)	2 Loss > 1 kg, < 5% BW	3 Loss > 5%
2: Dietary intake			
0 Good appetite/no ↓ intake pattern	1 Mild suboptimal solid intake	2 Moderate ↓ to full liquid	3 Hypo-caloric liquid, starvation
3: GI symptoms			
0 No symptoms/good appetite	1 Mild sx/↓appetite, some nausea	2 Occasional vomiting/mild sx	3 Frequent diarrhea, vomiting, severe anorexia
4: Functional capacity			
0 Normal to improved function	1 Some difficulty/frequently tired	2 Difficulty w/usual activities	3 Bed/chair ridden/little activity
5: Comorbidities			
0 Dialysis < 1 yr, otherwise healthy	1 Dialysis 1-4 yr/mild comorbidity	2 Dialysis > 4 yr, 1^{+} MCC	3 Severe comorbid, 2^{+} MCC
B: PHYSICAL EXAM			
6: Decreased fat stores of loss of subcutaneous fat (below eyes, triceps, biceps, chest)			
0 Normal, no change	1 Mild	2 Moderate	3 Severe
7: Signs of muscle wasting (temple, clavicle, scapula, ribs, quadriceps, knee, interosseous)			
0 Normal, no change	1 Mild	2 Moderate	3 Severe

COMPREHENSIVE MALNUTRITION INFLAMMATION SCORE (cont.)

C: BMI			
8: BMI			
0 BMI >20 kg/m^2	1 BMI 18-19.99 kg/m^2	2 16-17.99 kg/m^2	3 BMI < 16 kg/m^2
D: LABORATORY PARAMETERS			
9: Serum albumin			
0 ≥ 4.0 g/dL	1 3.5-3.9 g/dL	2 3.0-3.4 g/dL	3 < 3.0 g/dL
10: Serum TIBC			
0 >250 mg/dL	1 200-249 mg/dL	2 150-199 mg/dL	3 <150 mg/dL

Reference: Kalantar-Zadeh K, Kopple JD, Block G, Humphreys MH. A malnutrition-inflammation score is correlated with morbidity and mortality in maintenance hemodialysis patients. *Am J Kidney Dis.* 2001;38:1251-1263.

Other Composite Nutrition Indices: Reviews by Nutrition in CKD Practice Guidelines workgroup included: Geriatric Nutrition Risk Index (GNRI), Malnutrition Universal Screening Tool/Malnutrition Screening Tool (MUST/MST); Mini-Nutrition Assessment (MNA); Nutrition Impact Symptoms (NIS), Nutrition Screening Tool (NST); Renal Nutrition Screening Tool (R-NST), Protein-Energy Wasting (PEW) score; Nutrition Risk score, Protein Nutrition Index (PNI), Composite Score of Protein Energy Nutritional Status (cPENS). The large body of literature on nutritional assessment and composite nutritional indices have been completed in CKD 5D. While some of these tools may be relevant and can be translated to earlier stages (1-4) CKD, there is a need for the practitioner to conduct a comprehensive nutritional assessment comprising the main domains of the NCP.

Reference: Ikizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.

METHODS TO ASSESSMENT OF DIETARY INTAKE

Considerations When Assessing Dietary Intake

1.6.1. In adults with ***CKD 3-5D and posttransplantation,*** *it is reasonable to assess factors beyond dietary intake (eg, medication use, knowledge, beliefs, attitudes, behavior and access to food, depression, cognitive function, etc.) to effectively plan nutrition interventions (OPINION).*

3-Day Food Records to Assess Dietary Intake

1.6.2. In adults with ***CKD 3-5D,*** *we suggest the use of a 3-day food record, conducted during both dialysis and non-dialysis treatment days (when applicable), as a preferred method to assess dietary intake (2C).*

Example:

3-Day Food Intake Form

Fill out the following form with as much detail as possible. Complete 3 different days, including 1 dialysis day and 2 other days to show different patterns/foods that you eat or drink. Give detail about the type of food, brand/restaurant, etc) Record the amounts of each food that you eat (estimate in cups, ounces, teaspoons, tablespoons, etc.). Detail how the food was prepared (fried, cold, boiled, broiled, etc.). Explain where the food was eaten (home, friends, family, restaurant, etc.).
Return to your dietitian: _____

Day 1

Date	Time	Food or Beverage	Amount Eaten	How Prepared	Where Eaten?	Added Sugar, Salt, Sauce, Dressings?
6/5/20	7 am	Cornflakes	1 cup	Cold	Home	1 tsp sugar
		Milk	1/3 cup	Skim		

Reference: Ikizler TA, Burrowes J, Byham-Gray L, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020;76(suppl 1):S1-S107.

METHODS TO ASSESSMENT OF DIETARY INTAKE (cont.)

Alternative methods for assessing dietary intake include 24-hr food recalls, FFQs, and nPCR (protein).

24-hr Food Recall

- A structured interview intended to capture information about foods, beverages, dietary supplements consumed within the previous 24 hr (midnight to midnight)
- While it does not capture different eating patterns for unusual days, the client can be asked whether the day was typical or atypical, and in what way is it atypical
- One benefit is that the client may be able to recall over 24 hr and interviewer questions can be designed to prompt complete responses that capture all foods eaten, not just focused on what would be considered meals

FFQ: Semi-quantitative

- Includes questions on a set of food, beverage, and supplemental items (approximately 80-120 items) that might be ingested (appropriate for the population)
- Should include consumption frequency varying from never to very infrequently to multiple times per day/week
- Guidance for estimating portion sizes is helpful (size of fist = cup; also units should be detailed (eg, cups, teaspoons, tablespoons, ounces, cans, bottles) with the number of units consumed (eg, 1 cup, 12 oz)
- Frequency of consumption is required and my need to reflect differences in seasons, special occasions, etc. (eg, ask the pt to note if a day includes some special meal like a birthday)
- Brands and recipes are helpful to detail the composition of foods listed
- FFQ is to capture the intake of an individual and can be interviewer administered for low literacy or on children

References: Science Direct. FFQ. https://www.sciencedirect.com/topics/medicine-and-dentistry/food-frequency-questionnaire. Accessed 7/6/2020.
NIH. 24-Hr Dietary Recall at a Glance. https://dietassessmentprimer.cancer.gov/profiles/recall/. Accessed 7/6/2020.

Author Note: Many have had good success using a combination 24-hr recall and FFQ. The FFQ fills in some potentially missed foods and gives a more accurate picture of "usual" or "typical." For example, a pt may say that they do not drink any milk, but on the FFQ they say they have milk with cereal 3 days a week; thus, using an average of the information can provide a more complete estimate of overall intake.

ASSESSING FOR PICA

Pica refers to the persistent or compulsive craving and ingestion of nonfood or items with no nutritional value. Pica is quite common among dialysis pts (also common in children/pregnant women) and may be stimulated by the emotional stress associated with CKD. Nutritional, sensory, physiologic, psychosocial, and cultural theories have been suggested to explain pica, but the etiology is poorly understood. Nutrient deficiency may play a role and replenishment of the nutrient (eg, Fe) may lessen or stop the pica. Other cited causes include mental health issues, cultural/geographic practices, or poor education/instruction about inappropriate eating behaviors. Pica can affect dietary intake, nutrient status, micronutrient status, malabsorption, and malnutrition. Reports of other issues include bacterial infection, lead poisoning, mercury poisoning, hyper- or hypokalemia, P intoxication, constipation, diarrhea, abdominal pain, and even dental injury. The diagnosis of pica is established when the abnormal eating pattern has persisted for at least a month. Pica (Diagnostic and Statistical Manual of Mental Disorders) can be classified as no pica, ice pica, or hard pica. Examples of pica include starch, soil, clay, grass, paper, wallboard, plaster, glue, flour, aspirin, foam, chalk, sand, cigarette butts, ashes, soap, paint, buttons, feces, etc. Pica is usually described as a craving and is often related to texture.

Information about PICA in nutrition assessment must be obtained without judgement or blame and with sensitivity toward the pt. Often the question can be asked as "Do you eat or drink any items that are not considered food? Some examples would be ice or soil." Pts may be reluctant to share about pica, but some biochemical or physical clues may be observed. Geophasia (eating of dirt/soil/clay) has been associated with hyperkalemia (in the absence of other potential sources of K+). Chalk pica has been associated with hypercalcemia when other sources of Ca^{++} were minimal. It may be helpful to tactfully share an example of a situation where pica was the cause of a similar problem.

In a cross-sectional study of 400 dialysis pts in 2019, incidence of pica was 37-47%. Of those diagnosed with PICA, 46% ate ice, 29% ate soil, 14% ate 2 different substances, 5% ate red brick, 3% ate paper, 2% ate soap, and 1% ate "cattle pasture." Those who demonstrated pica were younger, more likely women, had longer duration of dialysis therapy, and had a lower level of education. In multivariate analyses, malnutrition, CRP, and lower education levels significantly and independently predicted both ice and hard pica. There was an association between the presence of pica and poorer nutritional status (no pica, 67%; ice pica, 80%; and hard pica, 89%. Thus while, this is a delicate subject, nutrition assessment/education must include identification and risks of pica.

References: Orozco-González CN, et al. Prevalence of pica in patients on dialysis and its association with nutritional status. *JREN*. 2019;29(2):143-148.
Federman DG, Kirshner RS, Federman GS. Pica: Are you hungry for the facts? *Conn Med*. 1997; 64(4):207-209.

COMMON SIGNS OF NUTRIENT DEFICIENCY IN PHYSICAL EXAM

Common body areas where physical signs of nutrient deficiency may occur are where cell turnover is rapid, such as eyes, hair, nails, skin, lips, and tongue. It is helpful to question the pt about S/S as many are not visible. Many of the signs may be due to other factors, such as medications, chronic diseases, severe illness, aging, blood loss, etc. Further evaluation to ascertain true nutrient deficiency should be undertaken. Always use PPE when touching the pt.

Area	Sign/Description	Potential deficiency
Eyes	Bitot's spots: white/gray spots on conjunctiva (outer layer)	Vit A
	Keratomalacia: night blindness; dry; dull, soft cornea	Vit A
	Pale conjunctiva	B_6, B_{12}, folate, Fe, copper/anemias
	Angular palpebritis (redness/fissures at corner of eyes)	Niacin, riboflavin, Fe, B_6
Face	Unhealthy pale appearance/pallor	Fe, folate, B_{12}, ascorbic acid
	Hyperpigmentation (neck, face, hands)	Niacin
Neck	Thyroid enlargement, goiter	Iodine
Lips/mouth	Angular stomatitis/cheilitis (swelling, fissures at corners of mouth)	Riboflavin, niacin, Fe, B_6 , B_{12}, Vit A toxicity
	Soreness/burning	Riboflavin
Teeth	Gray-brown spots	Excessive fluoride
Taste	Hypogeusia (altered, diminished sense of taste	Zinc
Tongue	Sore, swollen, red beefy tongue	Folate, niacin
	Sore, burning tongue, purplish/magenta	Riboflavin
	Glossitis (sore, swollen, red, smooth)	Riboflavin, niacin, B_6, B_{12}, folate, severe Fe
Gums	Gingivitis: spongy, bleeding, bright red retracted gums	Vit C, D, niacin, folate, zinc, excessive Vit A

COMMON SIGNS OF NUTRIENT DEFICIENCY IN PHYSICAL EXAM (cont.)

Area	Sign/Description	Potential deficiency
Hair	Lack of luster/color change Thin and sparse dyspigmentation Easy pluckability Swan neck/corkscrew Banding/flag sign (dark/light alternating)	↓protein/calories, manganese, selenium, copper ↓protein/calories, EFA Vit C ↓protein calorie
Skin	Xerosis (dryness, scaling) Follicular hyperkeratosis (hypertrophy around hair follicles/goose flesh) Petechiae (hemorrhagic spots in skin/mucosa) Pellagra (thick/scaling skin, hypo-pigmented spots on sun exposed) Slow healing/decubitus Eczema Purpura (purple colored spots/patches on skin and mucous membranes)	Vit A (high or low) Vit A or C Vit C, K Niacin, tryptophan, B_6 Zinc, ↓protein-calories Riboflavin, zinc Vit C, K, excessive Vit E
Nails	Koilonychia (spoon shaped, concave) Splinter hemorrhages Central ridges Beau's lines (transverse ridges, grooves on nail) Muehrcke's lines (transverse white lines) Brittle, soft, dry, weak or thin, easily split	Fe, anemia, protein deficiency Vit C Fe, folate, protein deficiency Severe zinc deficiency, folate, protein deficiency Hypoalbuminemia Mg, severe malnutrition

References: McLaren DS. A Colour Atlas and Text of Diet-Related Disorders. London: Mosby-Yearbook Europe; 1992.
Simko M, et al. Nutrition Assessment: A Comprehensive Guide for Planning Intervention. Gaithersburg, MD: Aspen Publishing; 1995.
Nutrition Focused Physical Exam. Available at: https://dakotadietitians.com/nutrition-focused-physical-exam/ Accessed 7/17/2020.
Skin Lesions Available at: https://www.skinvision.com/articles/how-do-common-skin-lesions-look-with-pictures/ Accessed 7/17/2020.
Micronutrient Exam: Clinical Interpretation of Nutrition Focused PE Available at: https://www.todaysdietitian.com/newarchives/images/MicronutrientTable0318.pdf. Accessed 7/18/2020.

Biochemical