Cardiovascular-Kidney-Metabolic Health: A 2023 Presidential Advisory From the AHA
Definition of Cardiovascular-Kidney-Metabolic Syndrome (CKM)

» A systemic disorder characterized by pathophysiologic interactions among metabolic risk factors, chronic kidney disease, and the cardiovascular system, leading to multi-organ dysfunction and a high rate of adverse cardiovascular outcomes.

» CKM syndrome includes both individuals at risk for cardiovascular disease due to the presence of metabolic risk factors and/or chronic kidney disease, and individuals with existing cardiovascular disease that is potentially related to or complicates metabolic risk factors and/or chronic kidney disease.

» The increased likelihood of CKM syndrome and its adverse outcomes is further influenced by unfavorable conditions for lifestyle and self-care resulting from policies, economics, and the environment.

Abbreviations: CKM indicates Cardiovascular-Kidney-Metabolic.
Definition of CKM Syndrome Simplified

Cardiovascular-kidney-metabolic (CKM) syndrome is a health disorder due to connections among heart disease, kidney disease, diabetes, and obesity leading to poor health outcomes.

Abbreviations: CKM indicates Cardiovascular-Kidney-Metabolic.
Stages of Cardiovascular-Kidney-Metabolic Syndrome

Abbreviations: Afib indicates atrial fibrillation; ASCVD, atherosclerotic cardiovascular disease; CHD, coronary heart disease; CKD, chronic kidney disease; CKM, cardiovascular-kidney-metabolic; CVD, cardiovascular disease; HF, heart failure; KDIGO, Kidney Disease Improving Global Outcomes; and PAD, peripheral artery disease.
Rationale for CKM Syndrome Staging

Reflects the pathophysiology of underlying CKM progression

Importance of early detection of under-recognized clinical conditions

Each stage to represent a higher level of absolute clinical risk

Principal focus on cardiovascular disease

The primary cause of premature mortality in relation to poor CKMH is CVD.

Additional focus on kidney failure

Each stage represents an opportunity for preventive intervention

The goal is to prevent the progression to the next stage

Abbreviations: CKM indicates Cardiovascular-Kidney-Metabolic; CKMH, Cardiovascular-Kidney-Metabolic Health; and CVD, cardiovascular disease.
Staging Rationale
Stage 0: No CKM Syndrome Risk Factors

» Individuals without overweight/obesity, metabolic risk factors, and CKD or subclinical/clinical CVD

» Primarily encountered in children, adolescents and young adults in the population

» Focus on primordial prevention

Abbreviations: CKD indicates chronic kidney disease; CKM, Cardiovascular-Kidney-Metabolic; and CVD, cardiovascular disease.

Staging Rationale

Stage 1: Excess and/or Dysfunctional Adiposity

» Overweight/obesity, abdominal obesity and/or dysfunctional adipose tissue, without the presence of other metabolic risk factors or CKD

» Adiposity at root of most metabolic risk factors and CKD but markedly under-addressed

» Several processes involved in the development of dysfunctional adipose tissue

» Impaired glucose tolerance is a clinical manifestation

» History of gestational diabetes increases risk of developing type 2 diabetes

Abbreviations: CKM indicates Cardiovascular-Kidney-Metabolic.
Staging Rationale

Stage 2: Metabolic Risk Factors and CKD

» The presence of metabolic risk factors and/or CKD

» Considerable pathophysiologic interactions among conditions

» Metabolic syndrome emphasizes interrelatedness of stage 2 conditions

» Hypertension

» CKD

» Emphasis on unique considerations for CVD prevention in the context of CKM conditions

Abbreviations: CKD indicates chronic kidney disease; CKM, Cardiovascular-Kidney-Metabolic; and CVD, cardiovascular disease.
Staging Rationale

Stage 3: Subclinical CVD in CKM

» Subclinical ASCVD or subclinical HF with excess/dysfunctional adiposity, other metabolic risk factors or CKD

» Additionally includes risk equivalents of people with high predicted CVD risk and very-high risk CKD

» Indicates high absolute CVD risk

» Prompt preventive therapy warranted

Abbreviations: ASCVD indicates atherosclerotic cardiovascular disease; CKD, chronic kidney disease; CKM, Cardiovascular-Kidney-Metabolic; and CVD, cardiovascular disease.
Staging Rationale

Stage 4: Clinical CVD in CKM

» Clinical CVD with excess/dysfunctional adiposity, other metabolic risk factors and/or CKD

» **Stage 4a:** no kidney failure

» **Stage 4b:** kidney failure present

» Management for CVD influenced by other CKM Syndrome conditions present

**Abbreviations:** Afib indicates atrial fibrillation; CHD, coronary heart disease; CKD, chronic kidney disease; CKM, cardiovascular-kidney-metabolic; CVD, cardiovascular disease; HF, heart failure; and PAD, peripheral artery disease.
Risk Enhancing Factors in CKMH

- Chronic inflammatory conditions
- High-risk demographic groups
- High burden of adverse SDOH
- Mental health disorders
- Sleep disorders
- History of premature menopause
- History of adverse pregnancy outcomes
- Polycystic ovarian syndrome
- Erectile dysfunction
- Elevated high-sensitivity C-reactive protein
- Family history of kidney failure, diabetes

Abbreviations: CKMH indicates Cardiovascular-Kidney-Metabolic Health; and SDOH, social determinants of health.
Screening

Rationale for CKM Syndrome Screening

- Detect asymptomatic individuals early for effective prevention
- Screening test criteria
- Accurate and reproducible
- Accessible at the population level and/or routine clinical practice
- Targeting where needed to “high yield” populations
- Ongoing screening for biological markers
- Screening for SDOH
- Allows for stage regression

**Abbreviations:** CKM indicates Cardiovascular-Kidney-Metabolic.

Screening for CKM Syndrome

Early Life Screening

Age <21 years

» Annual screening for overweight and obesity using sex- and age-specific CDC growth charts

» Mental and behavioral health screening

» Blood pressure assessment at least annually, and at every visit starting at age 3

» Fasting lipid panel between ages 9-11 and again between ages 17-21

» Positive family history of dyslipidemia- begin screening at age 2

» Screen for glucose intolerance and monitor alanine aminotransferase

» Assign appropriate CKM Syndrome stage and begin recommended prevention

Abbreviations: CDC indicates Centers for Disease Control and Prevention; and CKM, Cardiovascular-Kidney-Metabolic.
Screening for CKM Syndrome

**Adult Screening**
**Age >=21 years**

» BMI and waist circumference annually

» Blood pressure, HbA1c and lipid panel at stage-determined intervals

» Microalbumin and creatinine measurements at stage-determined intervals

» Screening for MASLD every 1-2 years as directed by guidelines

» CAC measurements as directed by guidelines

**Abbreviations:** BMI indicates body mass index; CAC, coronary artery calcium; CKM, Cardiovascular-Kidney-Metabolic; Hb A1C, hemoglobin a1C; and MASLD, metabolic dysfunction-associated steatotic liver disease.
Screening for CKM Syndrome

**SDOH Screening**

- Use established screening tools
- Financial strain
- Education/literacy
- Personal safety
- Mental health
- Screening tools can also assess for health behaviors impacted by SDOH

Incorporate an existing screening tool into the clinical care workflow and EHR

**Abbreviations:** CKM indicates Cardiovascular-Kidney-Metabolic; and SDOH, social determinants of health.

CKM Syndrome Prevention and Management
Interdisciplinary Care Models

**Value-based care**

» Involvement of interdisciplinary care team when any two of the following are present: CKD, diabetes, and subclinical/clinical CVD

» Interdisciplinary team
  - Primary care
  - Subspecialists
  - Pharmacy
  - Nursing
  - CKM coordinator

» Development of clinical protocols based on guidelines.

» Interdisciplinary team meets at regular intervals to discuss plan of care

**Volume-based care**

» Targeted referrals to subspecialists.
  - Nephrology
  - Endocrinology
  - Cardiology

» CKM coordinator assistance with patient navigation across multiple subspecialists

» Utilization of telemedicine to see subspecialists as needed

**Abbreviations:** CKM indicates Cardiovascular-Kidney-Metabolic.
CKM Syndrome Prevention and Management

Addressing SDOH in Care Model

- **Systematic screening** for SDOH using validated tools
- Integration of **SDOH assessments** into clinical care workflow and EHR
- Incorporation of **community health workers** into integrated care team for patient support and navigation
- Leveraging existing **community resources and community programs**

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CKM Syndrome Management Stages 1-3

**Stages 1-3: Patient With CKM Syndrome at Risk for CVD**

- **Promotion of cardiovascular health** with an emphasis on Lifestyle Essential 8 framework: eat better, be more active, quit tobacco, get healthy sleep, manage weight, control cholesterol, manage blood sugar, manage blood pressure
- **Systematic screening for CKD** using validated tools; incorporation of community health workers and care navigators into the care team; leveraging existing community resources and community programs

**Stage 1: Excess or Dysfunctional Adiposity**
- Discourage weight loss using STOP obesity alleviation tools
- Use moderate weight loss support via integrated team to facilitate lifestyle change
- Navigate weight loss options (lifestyle medicine, metabolic surgery, dietetics, pharmacy, mental health, childbirth, etc.)
- **Interdisciplinary care** — Use of CKM coordinator and interdisciplinary team; targeted referral of high-risk CKM patients to subspecialists

**Stage 2: Established CKM Risk Factors**
- Presence of metabolic syndrome triggers intensive lifestyle intervention targeting multifaceted risk control
- Pharmacotherapy for comprehensive control of multiply uncontrolled risk factors

**Stage 3: Subclinical CKD in CKM Syndrome**

**Interdisciplinary care** — Use of CKM coordinator and interdisciplinary team; targeted referral of high-risk CKM patients to subspecialists

**Abbreviations:**
- ACEi indicates angiotensin-converting-enzyme inhibitors; ARB, angiotensin II receptor blockers; ARNi, angiotensin receptor/neprilysin inhibitors; ASCVD, atherosclerotic cardiovascular disease; BP, blood pressure; BMI, body mass index; CHD, coronary heart disease; CHW, community health worker; CKD, chronic kidney disease; CKM, cardiovascular-kidney-metabolic; CVD, cardiovascular disease; DKD, diabetic kidney disease; DM, diabetes mellitus; EF, ejection fraction; GLP-1RA, GLP-1 receptor agonist; HbA1c, hemoglobin A1c; HF, heart failure; IGT, impaired glucose tolerance; MetS, metabolic syndrome; P2Y12i, P2Y12 inhibitors; SDOH, social determinants of health; SGLT2i, sodium-glucose transport protein 2 inhibitors; STOP, Strategies to Overcome and Prevent; and UACR, urine albumin-creatinine ratio.
CKM Syndrome Management Stage 4

**Abbreviations:**
- ACEi: angiotensin-converting-enzyme inhibitors
- ARB: angiotensin II receptor blockers
- ARNi: angiotensin II receptor/neprilysin inhibitors
- ASCVD: atherosclerotic cardiovascular disease
- BP: blood pressure
- BMI: body mass index
- CHD: coronary heart disease
- CHW: community health worker
- CKD: chronic kidney disease
- CKM: cardiovascular-kidney-metabolic
- CVD: cardiovascular disease
- DKD: diabetic kidney disease
- DM: diabetes mellitus
- EF: ejection fraction
- GDMT: guideline-directed medical therapy
- GLP-1RA: GLP-1 receptor agonist
- Hba1c: hemoglobin A1c
- HF: heart failure
- IGT: impaired glucose tolerance
- LDL: low-density lipoprotein
- MetS: metabolic syndrome
- P2Y12i: P2Y12 inhibitors
- SDOH: social determinants of health
- SGLT2i: sodium-glucose transport protein 2 inhibitors
- STOP: Strategies to Overcome and Prevent
- UACR: urine albumin-creatinine ratio
- UGDP: under-graduated physician
- UMR: under-matched resident
- UFM: under-fulfilled mission
- UBP: under-bounded patient
- UCR: under-certified physician
- ULC: under-labeled clinical
- UCC: under-certified clinical
- UADT: under-accessed diagnostic tests
- UADT: under-accessed diagnostic tests
- UACR: urine albumin-creatinine ratio

**Stage 4: Patient With CKM Syndrome With Existing CVD**

**Promotion of cardiovascular health**
- With an emphasis on LHI’s: Essential 8 framework (eat better, be more active, quit tobacco, get healthy sleep, manage weight, control cholesterol, manage blood sugar, manage blood pressure)
- Systematic screening for SDOH using validated tools, incorporation of community health workers and care navigators into the care team, leveraging existing community resources and community programs

**Interdisciplinary care**
- Use of OM-coordinator and interdisciplinary team
- Targeted referrals of high-risk patients with CKM to subspecialists

**Management of Excess or Dysfunctional Adiposity**
- Discuss weight loss using STOP obesity action tools
- Weight loss support via reimbursed teams to facilitate
- Weight loss through lifestyle change

**Management of Other CKM Risk Factors**

**Diabetes**
- Lifestyle modification
- Glycemic-lowering therapies

**Hypertension**
- Lifestyle modification
- Follow established hypertension guidelines to achieve BP <130/80 mmHg

**Hyperlipidemia**
- **In ASCVD**
  - To reduce MACE in other SGLT2i or GLP-1RA
  - To reduce HF hospitalizations and CV mortality in SGLT2i
  - Add SGLT2i to GLP-1RA
  - Add a P2Y12i to GLP-1RA
  - Add a GLP-1RA to SGLT2i
  - Consider adding a neprilysin inhibitor

**Chronic Kidney Disease**
- Maximize use of angiotensin-converting enzyme inhibitors and ARBs

**CKM Syndrome Management Stage 4**

Cardiovascular-Kidney-Metabolic Syndrome Call to Action

Patient-Centered Implementation Focus

Supporting Healthy Lifestyle in Communities

Implementation Within and Across Health Centers

Enhanced Obesity Management

CKM Education

Interdisciplinary Care

Addressing Research Gaps

Social Determinants of Health

Consideration of SDOH

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Cardiovascular-Kidney-Metabolic Syndrome
Call to Action
Consideration of SDOH

» Upfront priority for screening of SDOH to guide approaches to care
» Integration of SDOH assessments into clinical workflow and electronic health records
» Incorporation of individuals into the care team to address access, navigation, and social barriers
» Leveraging community resources for needs based on SDOH screening
» Need for more data on the impact of SDOH screening and addressing social needs on CKM risk factors and outcomes

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Cardiovascular-Kidney-Metabolic Syndrome

Call to Action

Interdisciplinary Care

- Interdisciplinary care for individuals with a confluence of CKM factors. Two complementary approaches:
  - Value-based care model: Use of CKM coordinator and interdisciplinary team to provide remote guidance regarding CKM care
  - Volume-based care model: targeted referrals of high-risk patients to Cardiology, Endocrinology, Nephrology

- May rely more on value-based care model in health centers/regions with a low density of subspecialists

- Appropriate reimbursement models and infrastructure needed

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Cardiovascular-Kidney-Metabolic Syndrome Call to Action

Access to Pharmacotherapies

Utilization of pharmacists and social workers on the interdisciplinary CKM team to facilitate access

Advocacy for policy level changes to ensure access

Incorporate representation of health systems, payors, patients, and caregivers into policy change advocacy measures

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Call to Action

Addressing Research Gaps

Need to address key gaps in CKM knowledge, screening, prevention, management and implementation of care models through intensified research efforts.

Emphasis on interdisciplinary and cross-specialty investigative approaches that reflect the interconnectedness inherent to CKMH.

Envision the possibility for research investments related to CKMH, in addition to research fellowships for trainees.

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Cardiovascular-Kidney-Metabolic Syndrome Call to Action

**CKM Education**

» Prioritize education for health care professionals and community members regarding CKMH
  - Underlying science and inter-connectedness of CKMH
  - Definition of CKM syndrome
  - CKMH staging
  - Prediction of outcomes in CKM
  - Approaches to CKM prevention and management

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Cardiovascular-Kidney-Metabolic Syndrome
Call to Action

Enhanced Obesity Management

» Enhance education about approaches to obesity

» Providing toolkit for addressing obesity in clinical encounters

» Emphasis on integrated teams to support a patient-centered approach to weight loss:
  - Obesity medicine, metabolic surgery, dietician, pharmacy, mental health, community health workers/care manager

» Need to advocate for better access to obesity pharmacotherapies and better reimbursement for obesity management in health centers
Cardiovascular-Kidney-Metabolic Syndrome Call to Action

Implementation within and across Health Centers

» Informed by the AHA’s CKMH initiative, validated CKMH measures and center-specific performance across registry-based data

» Patient-centric AHA CKMH certification program, allowing for the designation of an AHA Center for CKMH Excellence for institutions that meet criteria for optimal implementation of specified CKMH metrics.

» CKMH certification could activate implementation of key CKMH quality improvement metrics and hospital certification programs not only across GWTG hospitals in the US, but also in 13 other countries globally where the AHA is currently engaged, allowing for a scaled up global impact.

Abbreviations: AHA indicates American Heart Association; and CKMH, Cardiovascular-Kidney-Metabolic health.

Cardiovascular-Kidney-Metabolic Syndrome Call to Action

Supporting Healthy Lifestyle in Communities

» Critical need to support the achievement of ideal cardiovascular health, particularly healthy lifestyle, in community settings

» Will involve multi-level partnerships between AHA and outside stakeholders

» Emphasis on strategies to enhance cardiovascular health across the life course and across diverse communities
Cardiovascular-Kidney-Metabolic Syndrome

Patient-Centered Implementation Focus

Abbreviations: ASCVD indicates atherosclerotic cardiovascular disease; BMI, body mass index; CKD, chronic kidney disease; and UACR, urine albumin-creatinine ratio.