

---

# Metabolic Acidosis is Underdiagnosed and Undertreated in Patients with CKD

# Disclaimer

---

The content contained within this slide deck is for educational purposes only. Not for promotional purposes or re-distribution.

---

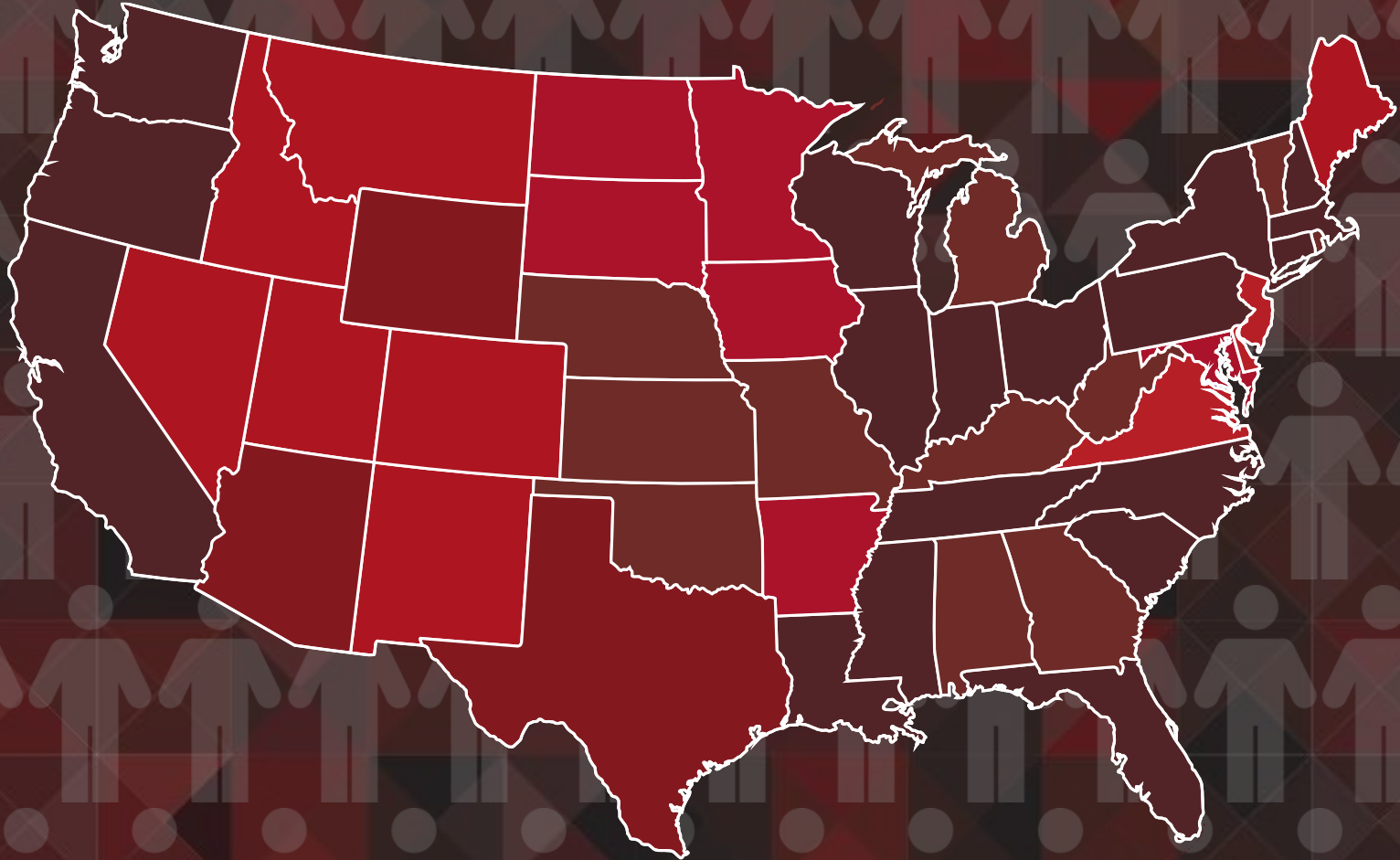
# Navdeep Tangri, MD, PhD

Associate Professor of Medicine  
Department of Medicine and Community Health Sciences  
University of Manitoba

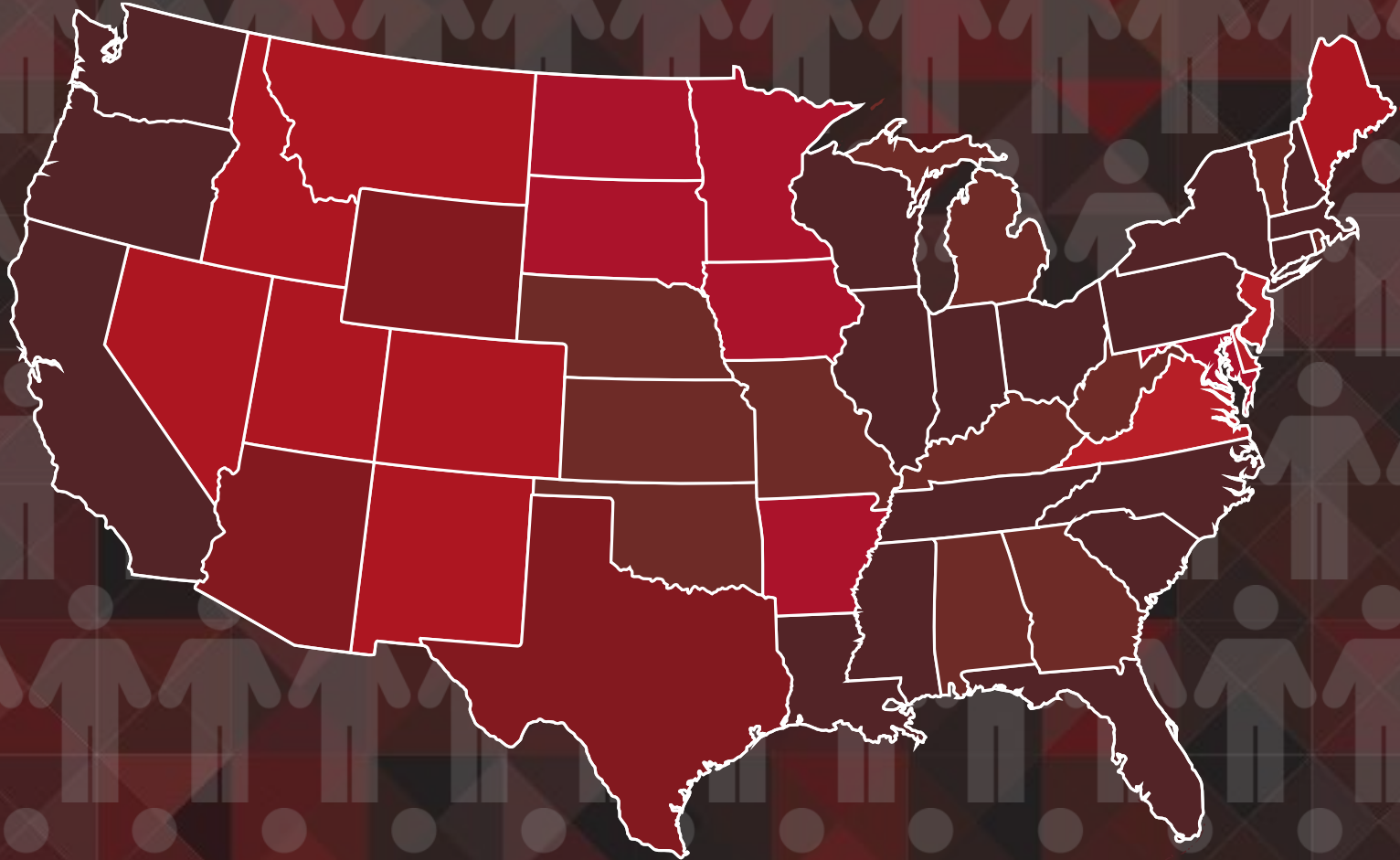
Scientific Director  
Chronic Disease Innovation Center  
University of Manitoba

*Disclosure: Dr. Tangri is a consultant to Tricida, Inc.*

# 37 Million People with CKD in the United States

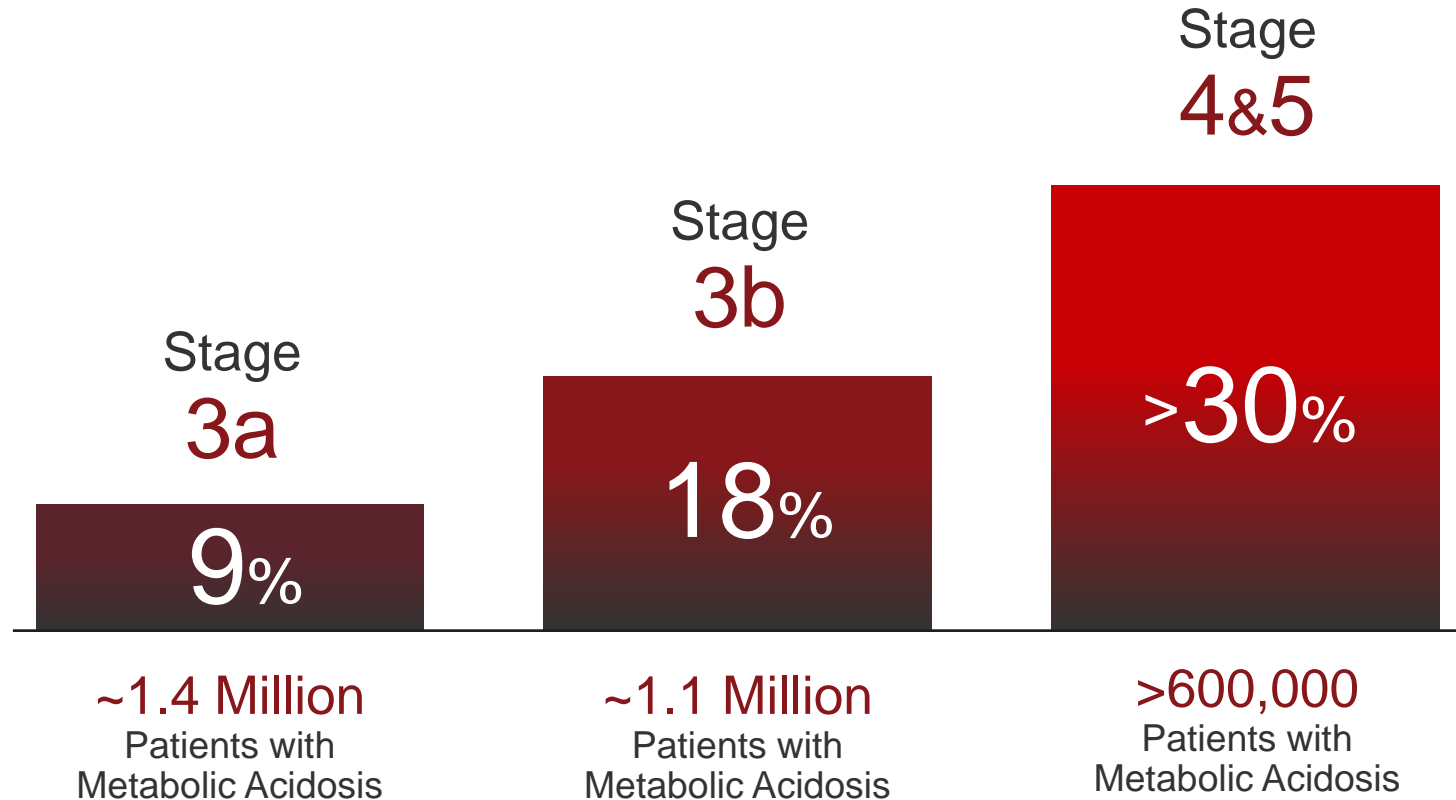


# 37 Million People with CKD in the United States



15% of US Adults are Afflicted with CKD

# Three Million Patients with Stage 3 to 5 CKD Affected by Metabolic Acidosis

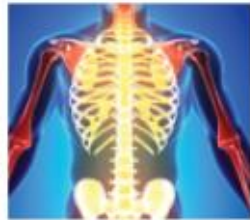


# The Consequences of Metabolic Acidosis are Wide Ranging



Reduced Renal Acid Excretion

Reduced Kidney Function



Acid Buffering Leads to Loss of Bone Density

Increased Risk of Fractures, Renal Osteodystrophy



Increased Protein Catabolism

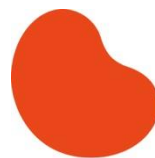
Muscle Wasting

# National and International Guidelines Suggest Treatment of Metabolic Acidosis



We suggest that in people with CKD and serum bicarbonate concentrations **<22 mmol/L** treatment with oral bicarbonate supplementation be given to maintain serum bicarbonate within the normal range, unless contraindicated.

Serum bicarbonate concentrations less than 22 mmol/l are associated with **risk of CKD progression and increased risk of death.**



National  
Kidney  
Foundation®

KDOQI®  
Kidney Disease  
Outcomes Quality Initiative

In CKD Stages 3, 4, and 5, the serum level of total CO<sub>2</sub> should be measured. The frequency of these measurements should be based on the stage of CKD (OPINION).

In these patients, serum levels of total CO<sub>2</sub> should be **maintained at >22 mEq/L (22 mmol/L)**. (EVIDENCE) If necessary, supplemental alkali salts should be given to achieve this goal. (OPINION).



# In the CRIC Study 2.7% of Patients with Metabolic Acidosis were Treated with Oral Alkali

**Table 1.** Baseline Characteristics of All Participants and According to Quartiles of Serum Bicarbonate

Characteristic	All Participants (N = 3,904)	Quartile of Serum Bicarbonate				P
		≤22 mEq/L (n = 1,039)	23-24 mEq/L (n = 924)	25-26 mEq/L (n = 968)	>26 mEq/L (n = 973)	
Alkali therapy	91 (2.4)	28 (2.7)	20 (2.2)	18 (1.9)	25 (2.6)	0.6
COPD	121 (3.2)	29 (2.8)	28 (3.1)	26 (2.7)	38 (4.0)	0.4
Body mass index (kg/m <sup>2</sup> )	32.1 ± 7.8	31.7 ± 7.4	32.4 ± 8.3	31.8 ± 7.5	32.5 ± 8.0	0.06
Systolic blood pressure (mm Hg)	128.5 ± 22.2	129.4 ± 21.9	127.9 ± 21.9	128.3 ± 22.5	128.5 ± 22.5	0.5
Diastolic blood pressure (mm Hg)	71.5 ± 12.8	71.3 ± 12.5	71.5 ± 12.8	72.0 ± 12.9	71.4 ± 13.2	0.6
Medication use						
Aspirin	1,662 (42.9)	421 (40.7)	394 (43.0)	410 (42.7)	437 (45.3)	0.2
β-Blockers	1,913 (49.3)	519 (50.1)	433 (47.2)	461 (48)	500 (51.9)	0.2
Statins	2,136 (55.1)	608 (59.7)	478 (52.1)	525 (54.6)	525 (54.5)	0.03
ACEi/ARBs	2,668 (68.8)	735 (71)	642 (70.0)	649 (67.5)	642 (66.6)	0.1
Alkali therapy <sup>a</sup>	91 (2.4)	28 (2.7)	20 (2.2)	18 (1.9)	25 (2.6)	0.6

# Real-World Diagnosis and Treatment Rates of Metabolic Acidosis in the United States

2016

2017

2018

De-Identified Lab Records

# Real-World Diagnosis and Treatment Rates of Metabolic Acidosis in the United States

2016

2017

2018

## De-Identified Lab Records

### Unequivocal lab-based evidence of CKD stage 3 to 5

- Two eGFR values  $< 60$  ml/min/1.73 m<sup>2</sup>
- 28 days apart
- No intervening eGFR values  $\geq 60$  ml/min/1.73 m<sup>2</sup>

### Unequivocal lab-based evidence of metabolic acidosis

- Serum bicarbonate values at least 28 days apart
- Two year study period
- Serum bicarbonate between 12 to  $< 22$  mEq/L
- Exclude if serum bicarbonate outside range at any time

**>118,000**

with Unequivocal Metabolic Acidosis and CKD

# >86,000 Patients with Laboratory Evidence of Metabolic Acidosis Also Had Claims Data

## Lab Data Records

The screenshot shows a software interface with three main data tables:

- Hematology:** Columns include Date, Time, WBC, High, Hct, Hgb, Plt, G, L, M, Eo, Bc, AL, Me, My, NRBC, RefC, and Other. Rows show data for dates 4/3/04, 4/4/04, 4/5/04, 4/6/04, 4/9/04, 4/10/04, and 4/11/04.
- Chemistry 1:** Columns include Date, Time, Na, K, Cl, CO2, BUN, Creat, Gluc, Ca, Phos, Mg, Anion Gap, and Other. Rows show data for dates 4/5/04, 4/7/04, 4/9/04, 4/10/04, 4/11/04, and 4/13/04.
- Chemistry 2:** Columns include Date, Time, TBA, DBA, ABPA, TBA, TBA, ALT, ALT, GGT, and Other. Rows show data for dates 4/4/04, 4/5/04, and 4/6/04.

### Claims Data

- One Claim within 3 months of qualifying eGFR value
- Excepting death
- Excepting patients with a diagnosis of acute kidney injury within 28 days prior to either qualifying serum bicarbonate value were excluded

FOR \_\_\_\_\_ DATE \_\_\_\_\_

ADDRESS \_\_\_\_\_ REFILL \_\_\_\_\_ TIMES

**R<sub>x</sub>**

Oral Alkali

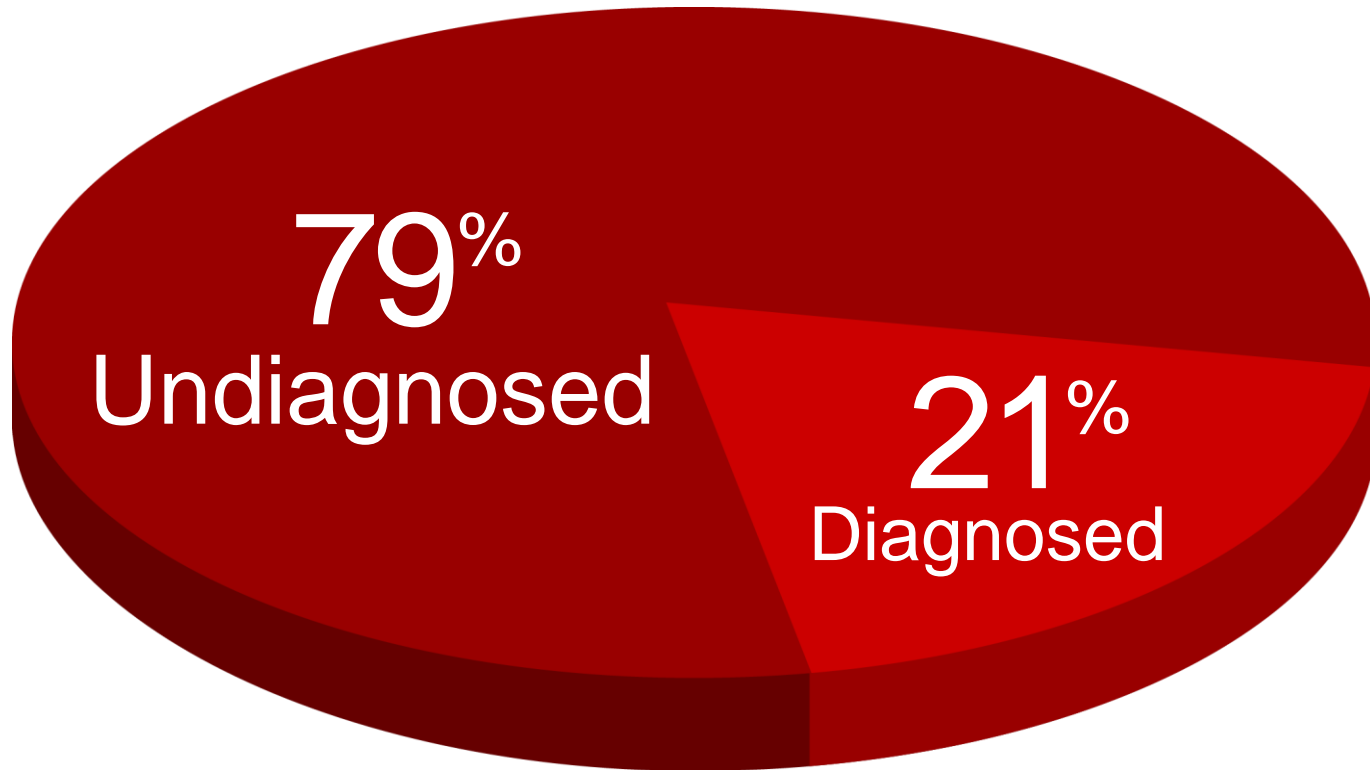
PRODUCT SELECTION PERMITTED \_\_\_\_\_ DISPENSE AS WRITTEN \_\_\_\_\_

DEA NO. \_\_\_\_\_ ADDRESS \_\_\_\_\_

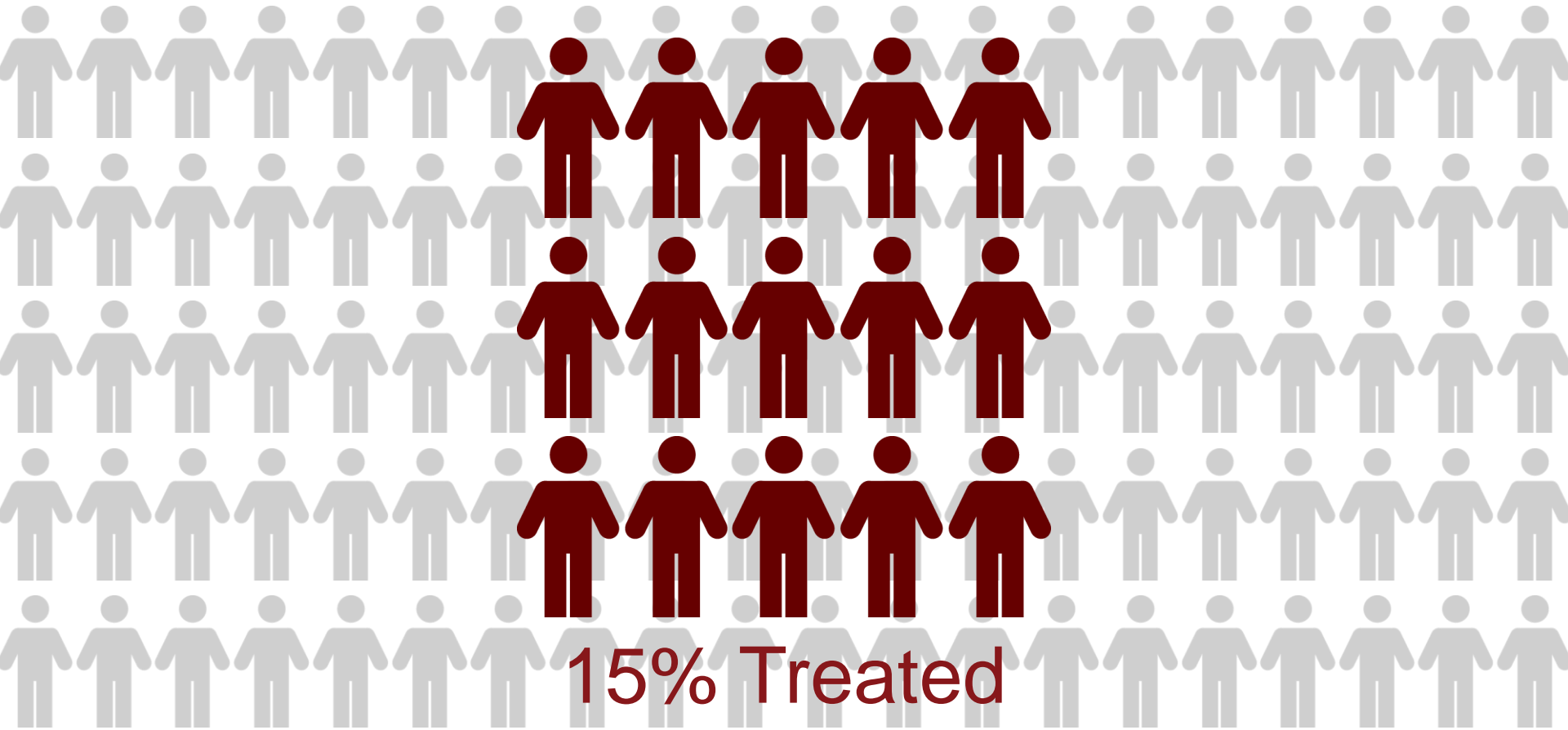
Reorder Item #6102 Total Pharmacy Supply, Inc. 1-800-878-2822

Confirmation of Claims to Assess Diagnosis and Treatment Rates

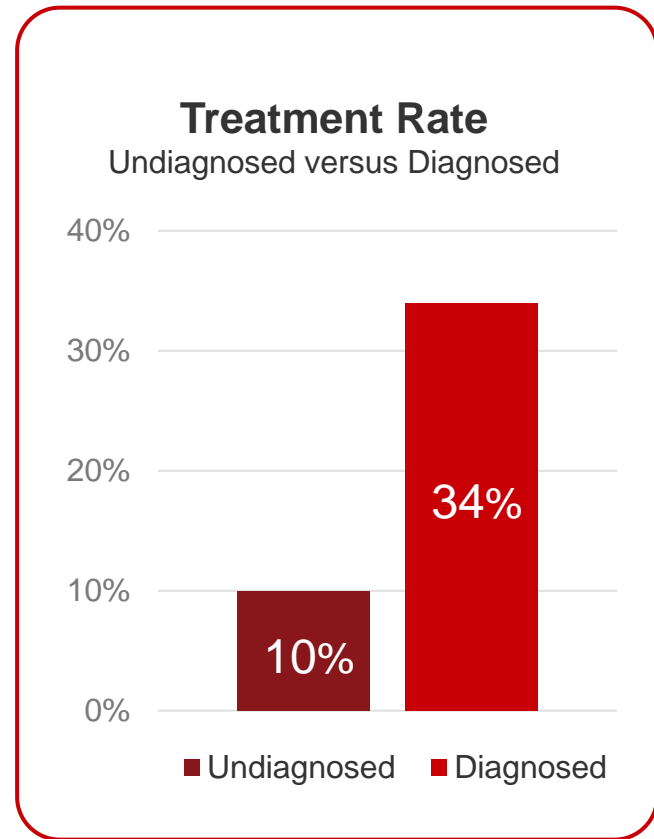
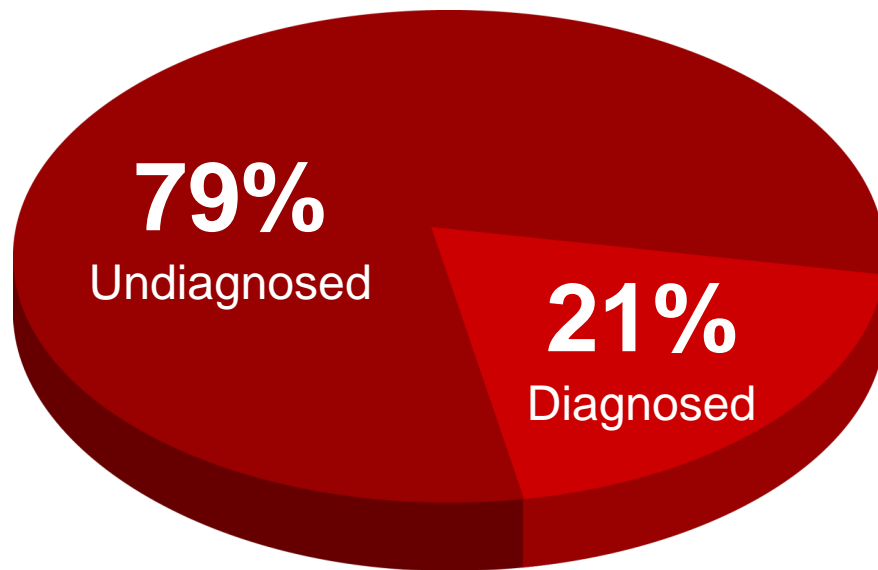
# ~80% of Patients with Metabolic Acidosis and Stage 3 to 5 CKD are Undiagnosed



# Only ~15% of Patients with Metabolic Acidosis and Stage 3 to 5 CKD are Treated



# ~80% of Patients with Metabolic Acidosis and Stage 3 to 5 CKD are Undiagnosed



---

# There is a Significant Diagnosis and Treatment Gap for Metabolic Acidosis as an Important Disease Modifying Complication of CKD



---

The End