# Worsening Heart Failure in Adults with Mild-to-Moderate **Chronic Kidney Disease**

Michael P. Girouard, Alan S. Go, Jane Y. Liu, Rishi V. Parikh, Thida C. Tan, Emily S. Lee, Grace Sun, Ankeet S. Bhatt, Leonid Pravoverov, Sijie Zheng, Jana Svetlichnaya, Jesse K. Fitzpatrick, Harshith R. Avula, Keane K. Lee, Sirtaz Adatya, Parag Goyal, Alexander T. Sandhu, and Andrew P. Ambrosy Kaiser Permanente Northern California, San Francisco, CA

### BACKGROUND

- Chronic kidney disease (CKD) is a major risk factor for heart failure (HF), and nearly half of HF patients experience renal dysfunction.
- HF patients with CKD are at high risk of morbidity and **mortality** but often receive suboptimal GDMT.
- A better understanding of the burden of worsening HF (WHF) events in mild-to-moderate CKD may guide preventative efforts.

### METHODS

- We analyzed a cohort of adults with mild-to-moderate CKD within a large, integrated US healthcare system from 2012-2021.
- A validated natural language processing algorithm was used to identify WHF events, including HF hospitalizations, emergency department visits, and outpatient encounters.
- Patients were stratified by degree of renal dysfunction and left ventricular ejection fraction (LVEF).

### RESULTS

- 11.3% of patients experienced WHF events, for a cumulative rate (95% CI) of 2.42 (2.40-2.44) per 100 person-years.
- WHF event rates increased with lower eGFR and greater albuminuria, ranging from 0.96 per 100 person years (Stage 1) to 4.67 per 100 person-years (Stage 3b).
- Incident HF occurred in 8.6% of patients over a median of 3.9 years, and >65% of cases were HF with preserved EF (HFpEF).

CKD Stage 3a N=108,872	
2787 (2.6)	1
8949 (8.2)	2
6,946 (24.8)	6
37,403 (34.4)	11
2,787 (30.1)	15
, <i>, , , ,</i>	
6,450 (42.7)	14
2,422 (57.3)	21
, <i>, , , ,</i>	
6,929 (61.5)	21
8184 (7.5)	2
7088 (6.5)	2
7826 (7.2)	2
291 (0.3)	
298 (0.3)	
7,875 (16.4)	63
8808 (8.1)	56
53.8 (4.2)	3
51.2 (204.8)	10
2,792 (39.3)	15
9,422 (17.8)	69
39 (0.0)	
2724 (2.5)	1
4,019 (12.9)	90
7,538 (43.7)	20
4,255 (22.3)	11
69 (0.1)	
.7	7,538 (43.7) 1,255 (22.3)



N=36,385

1035 (2.8) 2278 (6.3) 6739 (18.5) 1,205 (30.8) 5,128 (41.6)

4,779 (40.6) 1,606 (59.4)

1,865 (60.1) 2730 (7.5) 2697 (7.4) 2461 (6.8) 102 (0.3) 99 (0.3) 6363 (17.5)

5648 (15.5) 38.7 (4.3) 09.3 (352.7)

5,282 (42.0) 6913 (19.0) 8 (0.0) 1223 (3.4) 9041 (24.8) 0,025 (55.0) 1,063 (30.4)

13 (0.0)

## HF morbidity is common among patients with mild-tomoderate CKD.

## Half of HF-related morbidity in this cohort occurs in nonhospitalized encounters.

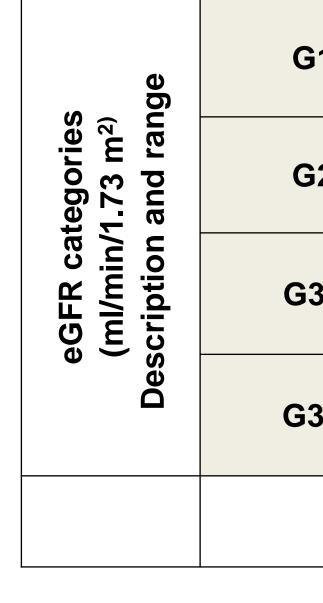
# The majority of incident HF cases in this cohort is HFpEF.

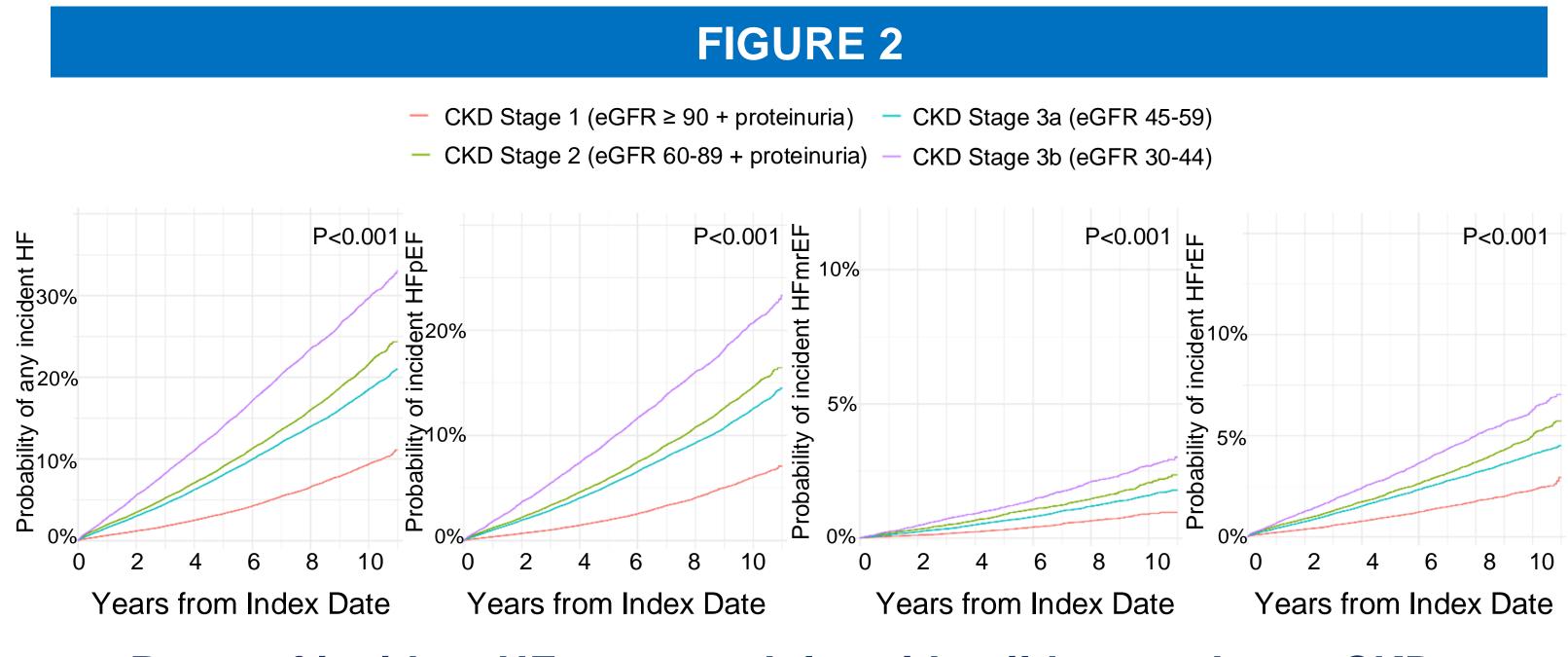




Rate pe







Rates of incident HF among adults with mild-to-moderate CKD stratified by LVEF and CKD stage

Dr. Go: Funding from NHLBI and NIDDK Dr. Ambrosy: Funding from NHLBI (K23HL150159 and R01AG091005), AHA (2nd Century Early Faculty Independence Award), The Permanente Medical Group, Northern California Community Benefits Programs, Garfield Memorial Fund, Abbott Laboratories, Amarin Pharma, Inc., Bayer, Cordio Medical, Edwards Lifesciences LLC, Esperion Therapeutics, Inc., Merck, and Novartis. Consultant to Corstasis, Merck, Novo Nordisk, scPharma The HEROIC study: Funding from Northern California Community Benefit Programs and Bayer Pharma AG

### FIGURE 1

			Albuminuria categories (mg/g) Description and range			
te of any WHF event			A1	A2	A3	
er 100 person-years <1.00 1.00-3.00			Normal to mildly increased	Moderately increased	Severely increased	Total (%)
3.00-5.00		<30 mg/g	30-300 mg/g	>300 mg/g		
61	Normal or high	≥90	N/A	31.6	2.3	33.9
<b>6</b> 2	Mildly decreased	60-89	N/A	24.9	2.5	27.5
3a	Mildly to moderately decreased	45-59	25.1	3.3	0.5	29.0
3b	Moderately to severely decreased	30-44	7.0	2.3	0.4	9.7
Total (%)		32.1	62.2	5.8	100.0	

### Heat map of WHF event rates per 100 person-years, stratified by degree of eGFR and albuminuria. Values represent the percentages of patients in each category.

### CONCLUSION

• WHF events increase with declining renal function measured by eGFR and proteinuria in adults with mild-to-moderate CKD.

 Cardiovascular-kidney-metabolic syndrome is increasingly recognized as a distinct pathophysiologic entity; here, we demonstrate that patients with even less severe CKD have significant HF-related morbidity. • Most incident HF in this cohort was HFpEF, corroborating the increasing evidence of pathophysiologic and treatment (e.g., nonsteroidal MRA, SGLT2i, and GLP1a) overlap between HFpEF and CKD.

### DISCLOSURES