ORIGINAL ARTICLE

Design and cohort characteristics of TRACK, a prospective study of hyperkalaemia management decision-making

Judith Hsia [1], Nitin Shivappa[2], Ameet Bakhai[3], Jordi Bover[4], Javed Butler [5], Pietro Manuel Ferraro [6], Linda Fried[7], Markus P. Schneider[8], Navdeep Tangri[9], Wolfgang C. Winkelmayer[10], Meredith Bishop[11], Hungta Chen[2], Anna-Karin Sundin[12] and Marc P. Bonaca[1]

[1]CPC Clinical Research, University of Colorado, Aurora, CO, USA, [2]AstraZeneca, Wilmington, DE, USA, [3]Royal Free NHS Hospital, London, UK, [4]Hospital Germans Trias i Pujol, Badalona, Spain, [5]Baylor Scott & White Research Institute, Dallas, TX, and University of Mississippi, Jackson, MI, USA, [6]Università degli Studi di Verona, Verona, Italy, [7]Pittsburgh Healthcare System, Pittsburgh, PA, USA, [8]University of Erlangen-Nürnberg, Erlangen, Germany, [9]University of Manitoba, Winnipeg, MB, Canada, [10]Baylor College of Medicine, Houston, TX, USA, [11]AstraZeneca, Gaithersburg, MD, USA and [12]AstraZeneca, Gothenburg, Sweden

Correspondence to: Judith Hsia: E-mail: judith.hsia@cpcmed.org; Twitter handle: ✕ @cpcresearch

ABSTRACT

Background. Guideline-recommended hyperkalaemia management includes dietary potassium (K^+) restriction, bicarbonate correction, diuretics and K^+ binders with dose reduction of renin–angiotensin–aldosterone system inhibitors as a last resort. The extent to which these recommendations are implemented is uncertain, as real-world data on hyperkalaemia management are limited. The Tracking Treatment Pathways in Adult Patients with Hyperkalemia (TRACK) study is a multinational, prospective, longitudinal study that is being conducted to address this knowledge gap. We report the design and baseline cohort characteristics of this real-world study of hyperkalaemia management decision-making.
Methods. This study enrolled participants within 21 days of an episode of hyperkalaemia in four European countries (UK, Spain, Germany, Italy) and the USA. During the 12-month follow up, data collected will include participant and healthcare provider characteristics (specialty and practice setting), hyperkalaemia treatment objectives and strategies, rationale for management decisions and indicators of response and patient-reported perceptions of their hyperkalaemia treatment.
Results. The enrolled cohort includes 1330 participants, mean age 68 years, of whom 31% were women. At baseline, 6% reported heart failure, 55% chronic kidney disease, 29% both and 9% neither. Most participants (57%) were taking an angiotensin-converting enzyme inhibitor, angiotensin receptor blocker or angiotensin receptor/neprilysin inhibitor at baseline. Mineralocorticoid receptor antagonist use was lower (14%).

Conclusions. The prospective TRACK study will shed light on practitioners' hyperkalaemia management decision-making and assess the impact of their decisions on hyperkalaemia recurrence. Understanding practitioners' underlying thought processes will facilitate efforts to improve hyperkalaemia management.

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Keywords: chronic kidney disease, heart failure, hyperkalaemia management, RAASi, real-world evidence

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KEY LEARNING POINTS

What was known:

- Although professional societies provide recommendations for managing hyperkalaemia, little is known about practitioners' real-world decision-making. The TRACK study aims to address this knowledge gap.

This study adds:

- We describe the design of the TRACK study, which collects information about healthcare providers, their hyperkalaemia management decision-making, response to treatment, participant characteristics and perceptions of their hyperkalaemia care.

Potential impact:

- Improved understanding of the basis for hyperkalaemia treatment choices may support the medical community in optimizing the use of evidence-based therapies such as potassium binders in patients with recurrent hyperkalaemia or maintaining renin–angiotensin–aldosterone system inhibitors in those with heart failure and/or chronic kidney disease.

INTRODUCTION

In a general outpatient population, the prevalence of hyperkalaemia is 1.3% [1], increasing 5-fold among patients with heart failure and up to 20-fold among those with chronic kidney disease (CKD) [2]. Hyperkalaemia predicts poorer survival as well as increased risk of kidney and cardiovascular events, including life-threatening arrhythmias, higher healthcare costs [3, 4] and poorer quality of life [5].

Hyperkalaemia recurrence is common. Following an index episode of hyperkalaemia in patients with CKD stage 3–4, recurrence was identified in 37% within 1 month and 56% within 6 months [6]. One of the major risk factors for recurrent or persistent hyperkalaemia is the use of renin–angiotensin–aldosterone system inhibitors (RAASis), an important therapy demonstrated to slow CKD progression and lower the risk of cardiovascular events. International best practice recommendations for management of hyperkalaemia include maintaining RAASi medications where possible and the use of newer potassium (K^+) binders to enable maximal dosing of these disease-modifying therapies [7–9]. The extent to which these recommendations are implemented is uncertain, as real-world data on hyperkalaemia management are limited. We designed and are conducting the Tracking Treatment Pathways in Adult Patients with Hyperkalemia (TRACK) study to better understand hyperkalaemia management, treatment patterns and provider treatment decision-making during routine clinical care. This report describes the study design and baseline characteristics of the fully enrolled cohort.

MATERIALS AND METHODS

TRACK is a prospective cohort study that enrolled patients in the USA and four European countries (UK, Spain, Germany and Italy) within 21 days following an episode of hyperkalaemia, defined as serum/plasma K^+ concentration >5.0 mmol/l, with a planned 1-year follow-up. The primary objective is to describe hyper-

kalaemia management decisions, their rationale and treatment expectations. The secondary objective is to describe baseline characteristics and longitudinal clinical variables in patients with hyperkalaemia. The exploratory objective is to describe patient awareness and satisfaction with their hyperkalaemia management. The study was approved by central and local institutional review boards/independent ethics committees and all participants provided informed consent.

As a pragmatic real-world evidence study, eligibility criteria were streamlined and selected to reflect a broad range of patients with a recent episode of hyperkalaemia (Table 1). No in-person visits and no specific procedures are required. Data describing current real-world management of hyperkalaemia are collected by medical records review and from healthcare providers (Table 2) via electronic case reports at baseline and 3, 6, 9 and 12 months following enrolment (Fig. 1).

Patient and healthcare provider characteristics

We recorded participants' demographics. concomitant medications and medical history (Table 2), including the presence and stage of CKD assessed from calculated estimated glomerular filtration rate (eGFR) using the 2021 Chronic Kidney Disease Epidemiology Collaboration equation [10] and albumin:creatinine ratio, presence of heart failure and reported left ventricular ejection fraction.

Healthcare providers were asked to record their specialty (nephrology, cardiology, primary care, other), demographics, years of experience and number of patients with hyperkalaemia managed each month.

Data collection during follow-up

Participants are followed for 12 months by electronic medical records review at 3-month intervals for hyperkalaemia recurrence. Healthcare providers record their hyperkalaemia treatment objectives, management decisions and indicators

Table 1: Eligibility criteria.

Inclusion criteria	• Age ≥18 years
	• [K$^+$] >5.0 mmol/l collected during standard of care within 21 days prior to the date of enrolment
	• Provision of informed consent
Exclusion criteria	• Concurrent participation in any trial that includes the use of K$^+$ binders as an investigational medicinal product
	• Patients with pseudo-hyperkalaemia
	• Acute causes of hyperkalaemia, such as infections and/or trauma, to be determined by the principal investigator
	• Life expectancy of <6 months, based on physician judgement
	• Kidney transplant anticipated or planned during the study period
	• Involvement in the planning and/or conduct of the study

Table 2: Study objectives and data collected.

Objectives	Data collected
Primary objective: to describe hyperkalaemia management decisions, their rationale and treatment expectations	Healthcare provider-related variables • Hyperkalaemia management decision • Hyperkalaemia management objective(s) (e.g. to achieve GDMT target doses of RAASi for CKD and HF) • Expected hyperkalaemia management duration Indicators of response • Normalization in [K$^+$] levels • Time to [K$^+$] normalization • Hyperkalaemia recurrence frequency • GDMT target doses of RAASi • Time to achieve GDMT target doses of RAASi • Occurrences of hyperkalaemia complications such as arrythmia, muscle weakness, and metabolic acidosis • Healthcare resource utilization
Secondary objective: to describe the baseline and longitudinal clinical variables of patients with established hyperkalaemia irrespective of previous hyperkalaemia diagnoses	Demographics (age, sex, and in the USA, race/ethnicity) Medical history • Comorbidities coded to MedDRA terms • Hyperkalaemia treatment history (including use of diet, K$^+$ binders and reduction in RAASi dosing) Medication history (especially RAASi therapy and doses) Laboratory • [K$^+$] • Serum creatinine • Urine albumin:creatine ratio Left ventricular ejection fraction Healthcare resource utilization—overall, heart failure and CKD-specific Dialysis-specific information
Exploratory objective: to describe patient awareness and satisfaction with their hyperkalaemia management	Patient-reported outcomes • Patient awareness of their hyperkalaemia management • FACIT-TS-G • Patient awareness of dietary recommendations

GDMT: guideline-directed medical treatment; MedDRA: Medical Dictionary for Regulatory Activities.

of response for the index episode of hyperkalaemia and all subsequent episodes during the 12-month follow-up period (Table 2). Participants are invited to complete an online questionnaire about awareness of their hyperkalaemia management, including whether they received advice about a low K$^+$ diet, medications for hyperkalaemia or adjustments to medications taken for other health conditions (see supplementary material). For those indicating receipt of dietary recommendations, additional questions are asked about how this was provided and their satisfaction with the dietary advice. Participants prescribed medications for hyperkalaemia are asked to complete the validated eight-item Functional Assessment of Chronic Illness Therapy—Treatment Satisfaction—General (FACIT-TS-G) survey [11].

Statistical methods

Assuming a dropout rate of 5%, a sample size of 1250 patients would provide a margin of error of <3% to estimate an endpoint of interest at month 12, providing adequate precision in the point estimation.

Rules and conventions to be used in the presentation and analysis of the study objectives as defined in the study protocol were prespecified in a statistical analysis plan. As the study will not be testing formal statistical hypotheses, no confirmatory testing is planned. Continuous variables are presented as mean and standard deviation (SD). Categorical variables are presented by numbers and percentages. P-values are calculated by Fisher's exact test or Pearson's chi-squared test.
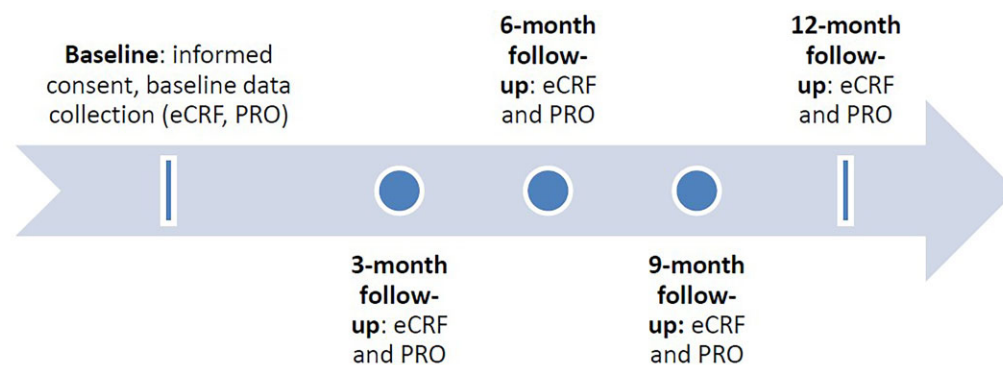
Figure 1: Study schema. Participants were enrolled within 21 days of an episode of hyperkalaemia, defined as [K+] >5.0 mmol/l. Baseline data were recorded from the medical record and directly from healthcare providers. Follow-up contacts at 3, 6, 9 and 12 months recorded healthcare utilization, medical diagnoses and laboratory results from the medical record.

Table 3: Baseline characteristics of the TRACK cohort by country.

Characteristics	Overall (N = 1330)	Germany (n = 230)	Italy (n = 309)	Spain (n = 259)	UK (n =301)	USA (n = 231)
Age (years), mean (SD)	67.7 (13.6)	72.8 (12.3)	69.3 (13.2)	69.2 (11.4)	62.0 (14.5)	66.4 (13.8)
Missing, *n*	1		1			
Female, *n* (%)	416 (31)	74 (32)	102 (33)	84 (32)	90 (30)	66 (29)
Body mass index (kg/m^2), mean (SD)	28.3 (6.4)	27.9 (5.8)	26.2 (5.2)	28.2 (5.6)	29.0 (7.1)	30.6 (7.3)
Missing	42	2	12	5	22	1
History of CKD/heart failure, *n* (%)						
CKD	736 (55)	50 (22)	170 (55)	137 (53)	225 (75)	154 (67)
Heart failure	83 (6)	23 (10)	19 (6)	21 (8)	13 (4)	7 (3)
CKD and heart failure	385 (29)	87 (38)	94 (30)	96 (37)	49 (16)	59 (26)
Neither CKD nor heart failure	122 (9)	70 (30)	22 (7)	5 (2)	14 (5)	11 (5)
Missing	4		4			
Patients with CKD, *n* (%)	1121	136	264	233	274	213
Stage 1 or 2	73 (7)	25 (18)	12 (5)	19 (8)	8 (3)	9 (4)
Stage 3a	159 (14)	33 (24)	26 (10)	33 (14)	27 (10)	40 (19)
Stage 3b	205 (18)	35 (26)	41 (16)	36 (16)	31 (11)	62 (29)
Stage 4	296 (26)	27 (20)	53 (20)	86 (37)	83 (30)	47 (22)
Stage 5, not on chronic dialysis	105 (9)	0	38 (14)	20 (8)	48 (18)	2 (1)
Stage 5, on chronic dialysis	282 (25)	16	94 (36)	39 (15)	77 (28)	53 (25)
Missing	1	1				
Medications, *n* (%)						
ACEi/ARB/ARNI	764 (57)	164 (71)	148 (48)	183 (71)	150 (50)	119 (52)
At target ACEi/ARB/ARNI dose	532 (70)	129 (79)	96 (65)	97 (53)	120 (81)	90 (76)
Missing	1				1	
MRA	183 (14)	41 (18)	42 (14)	68 (26)	24 (8)	8 (4)
At target MRA dose	115 (63)	34 (83)	22 (52)	39 (57)	13 (54)	7 (88)
[K$^+$] (mmol/l), *n* (%)						
≤5.0	5 (0.4)	1 (0.4)	1 (0.3)	1 (0.4)	0	2 (1)
>5.0–≤5.5	809 (62)	158 (70)	191 (66)	155 (61)	153 (52)	152 (66)
>5.5–≤6.0	361 (27)	48 (21)	72 (23)	77 (30)	106 (36)	58 (25)
>6.0–≤6.5	83 (6)	7 (3)	19 (6)	17 (7)	28 (9)	12 (5)
>6.5	43 (3)	13 (6)	8 (3)	6 (2)	10 (3)	6 (3)
Missing	29	3	18	3	4	1

RESULTS

Between 14 July 2022 and 15 December 2023, 1376 patients were screened and 1330 enrolled in the TRACK study from 93 sites in five countries: Germany, Italy, Spain, UK and USA. Cohort demographics and baseline characteristics, overall and by country, are summarized in Table 3. For 37% of participants, the qualifying episode of hyperkalaemia was their first. For patients qualifying with a recurrent episode of hyperkalaemia, the most recent episode occurred 5.6 months (mean) and 1.7 months (median) prior. Race and ethnicity were only reported for US participants, of whom 66% were White, 29% Black and 8% Hispanic/Latino.
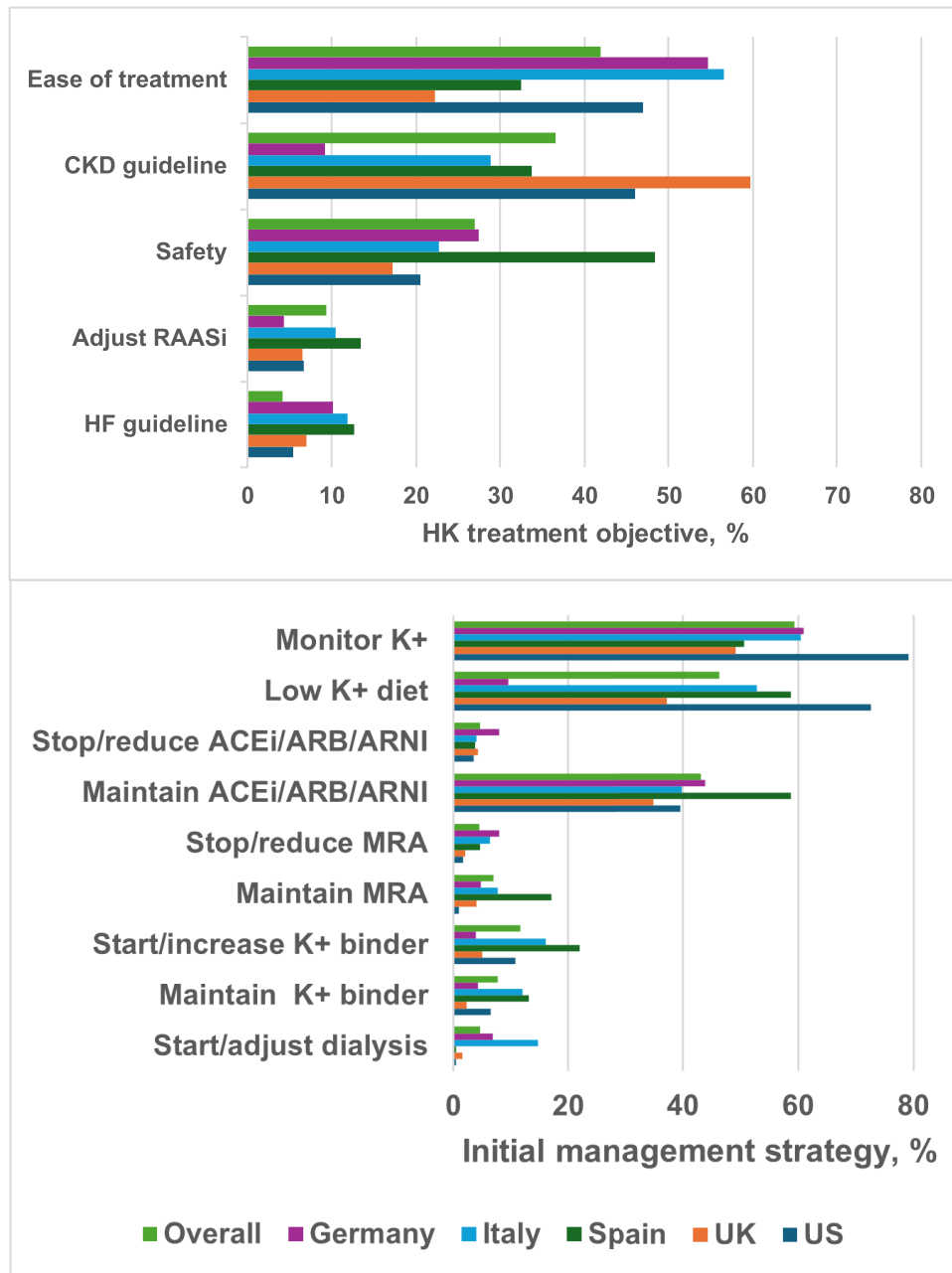
Figure 2: Hyperkalaemia treatment objectives and initial management strategy by country. The most common hyperkalaemia treatment objectives (upper panel) and initial management strategies (lower panel) are shown by country. Providers could record multiple responses for each participant.

Participants were enrolled across the spectrum of CKD severity, with 7% in CKD stage 1 or 2 and 14%, 18% and 26% in stages 3a, 3b and 4, respectively. Among 387 participants (35%) with CKD stage 5, 282 (73%) were receiving chronic dialysis (96% haemodialysis, 4% peritoneal dialysis).

Most participants (57%) were taking an angiotensin-converting enzyme inhibitor (ACEi), angiotensin receptor blocker (ARB) or angiotensin receptor neprilysin inhibitor (ARNI) at baseline, although the proportion at target dose varied by country. Mineralocorticoid receptor antagonist (MRA) use was lower (14%) and potassium binder use infrequent [sodium zirconium cyclosilicate (SZC) 2%, patiromer 0.4%, sodium/calcium polystyrene sulfonate 1%]. Sodium-glucose co-transporter-2 inhibitor use was reported by 26% of participants at baseline.

Mean baseline [K^+], assessed within 21 days of the index hyperkalaemia episode, was 5.5 mmol/l (SD 0.44) and ranged from 4 to 9 mmol/l. Mean baseline creatinine was 308 mmol/l (SD 278).

Healthcare providers

The most commonly reported hyperkalaemia treatment objectives were ease of treatment (42%) and CKD guideline adherence (37%), followed by safety, ACEi/ARB/ARNI adjustment and adherence to heart failure guidelines (Fig. 2). Variation by

Table 4: Hyperkalaemia treatment objective and initial management strategy by provider specialty.

Characteristics	Nephrologists	Non-nephrologists	Cardiologists	Non-cardiologists
Participants with provider specialty reported, *n*	597	327	237	687
Treatment objective, *n* (%)				
Number with response	553	313	227	639
Ease of treatment	196 (35)	145 (46)	77 (34)	264 (41)
Safety	170 (31)	97 (31)	92 (41)	175 (27)
Heart failure guidelines	18 (3)	72 (23)	66 (29)	24 (4)
CKD guidelines	285 (52)	26 (8)	14 (6)	297 (47)
Adjust RAASi	50 (9)	36 (12)	34 (15)	52 (8)
Initial management strategy, n (%)				
Number with response	588	327	237	678
Low K^+ diet	400 (68)[b]	71 (22)	42 (18)[b]	429 (63)
ACEi/ARB/ARNI[a]	265 (45)[b]	194 (59)	42 (18)[c]	429 (63)
Discontinued	12 (5)	8 (4)	8 (6)	12 (4)
Dose reduced	8 (3)	5 (3)	5 (4)	8 (2)
Dose maintained	237 (88)	170 (88)	115 (83)	292 (91)
Dose increased	4 (2)	6 (3)	6 (4)	4 (1)
Started	7 (3)	8 (4)	7 (5)	8 (2)
MRA[a]	26 (4)[b]	99 (30)	90 (38)[b]	35 (5)
Discontinued	5 (19)	17 (17)	15 (17)	7 (20)
Dose reduced	2 (8)	13 (13)	12 (13)	3 (9)
Dose maintained	18 (69)	65 (66)	59 (66)	24 (69)
Dose increased	1 (4)	1 (1)	1 (1)	1 (3)
Started	0	5 (5)	5 (6)	0
K^+ binder[a]	152 (26)[b]	45 (14)	39 (16)[c]	158 (23)
Discontinued	1 (0.7)	0	0	1 (1)
Dose reduced	1 (0.7)	0	0	1 (1)
Dose maintained	58 (38)	10 (22)	8 (21)	60 (38)
Dose increased	21 (14)	2 (4)	1 (3)	22 (14)
Started	71 (47)	33 (73)	30 (77)	74 (47)
Dialysis (started, unscheduled, changed prescription)	24 (4)[b]	0	0[b]	24 (4)

Participants can be counted in more than one row. Not all response options are shown. *P*-value calculated by Fisher's exact test for dialysis comparisons or by Pearson's chi-squared test for other comparisons.
[a]For medication dose change or discontinuation, *n* is the number of participants for whom a response is provided for the medication category. Denominator for calculating the percentage is the number of participants for whom any initial management strategy is provided.
[b]$P < .0001$ versus non-nephrologists or non-cardiologists.
[c]$P < .05$ versus non-cardiologists.

country was observed, with ease of treatment being the most common objective in Germany, Italy and the USA, while safety was the most common in Spain. The most frequently reported initial management strategy was [K^+] monitoring (59% overall), followed by adoption of a low K^+ diet (46%) and maintenance of ACEi/ARB/ARNI (43%). Discontinuation or dose reduction of ACEi/ARB/ARNI or MRA was infrequent, 5% for each. Country-specific strategies included higher K^+ binder use in Spain, Italy and the USA; dialysis adjustment or initiation was more frequently reported in Italy.

Healthcare providers were invited to provide their specialty: 597 (45%) participants were managed by nephrologists, 237 (18%) by cardiologists and 90 (7%) by another specialist; 30% did not specify their specialty. Nephrologists were more likely than non-nephrologists to cite CKD guideline compliance as an objective, prescribe a low-K^+ diet and manage K^+ binder therapy (both $P < .0001$ versus non-nephrologists) and less likely to manage, i.e. prescribe, adjust dose, decide to maintain dose or discontinue RAASi therapy as an initial strategy ($P < .0001$; Table 4). Cardiologists were more likely than non-cardiologists to manage RAASi therapy as an initial strategy ($P < .05$ for ACEi/ARB/ARNI, $P < .0001$ for MRA) and less likely to manage K^+ binder therapy ($P < .05$).

DISCUSSION

TRACK is a prospective, pragmatic, observational study designed to shed light on healthcare provider decision-making in patients with a diagnosis of hyperkalaemia, the rationale underpinning providers' management choices and treatment expectations. By including providers from a variety of specialties in Europe and the USA, the study is expected to provide clinical insights across a broad spectrum of real-world practice settings. Another strength is its enrolment of subjects across the range of CKD, including patients on dialysis, which will shed light on important differences in hyperkalaemia management and provider attitudes across stages of CKD.

Prospective, contemporaneous longitudinal data on hyperkalaemia management decision-making are needed to support the implementation of evidence-based therapies by improving our understanding of providers' treatment objectives, acute versus chronic management strategies and the effectiveness of these strategies. For example, identifying predictors of hyperkalaemia recurrence may facilitate targeted chronic use of newer K^+ binders. Knowledge of the steps practitioners take to achieve or maintain optimal doses of RAASis [12–14] in different countries and across provider subspecialties can help

professional societies and health systems shape treatment protocols and supportive messaging. Understanding patient perceptions about their treatment may identify barriers to lifestyle change and medication adherence [15].

Although hyperkalaemia management recommendations are widely available, reports of real-world management among boots-on-the-ground practitioners are limited. A retrospective analysis of data from the Veterans Affairs Corporate Data Warehouse (2016–2018) identified 288 patients with $[K^+] \geq 5.1$ mmol/l who started patiromer or sodium polystyrene sulfonate (SPS) and were not on chronic dialysis. SZC was not available during the study time frame. Of patients who started patiromer, 97%, 40% and 25% remained on therapy at 1, 3 and 6 months, respectively. Of those who started SPS, 25%, 5% and 2% remained on therapy at 1, 3 and 6 months, respectively. More than 70% of participants had $[K^+] <5.1$ mmol/l up to 6 months post-index hyperkalaemia episode. At baseline, 32% were taking an RAASi; ≈80% continued their RAASi therapy during the 6-month follow-up period [16]. In this population, chronic therapy with a K^+ binder lowered $[K^+]$ and a high proportion of RAASi users were able to continue RAASi therapy.

In a retrospective analysis of US claims data (2016–2017) that included patients with a diagnosis of hyperkalaemia who were treated with patiromer ($n = 610$), SPS ($n = 5556$) or no K^+ binder ($n = 21\,282$), RAASi use at the time of the index hyperkalaemia event was reported for 35%, 43% and 40% of patients in the respective groups [17]. During the 6 months following the index hyperkalaemia event, persistent RAASi utilization was numerically higher among patients with persistent patiromer use (patiromer 78%, SPS 57%, no K^+ binder 57%).

In a retrospective, propensity-matched analysis of claims data from patients with an episode of hyperkalaemia taking RAASi medication in the USA ($n = 582$), Japan ($n = 888$) and Spain ($n = 104$), RAASi dose maintenance or up-titration was more frequent at 6 months post-index hyperkalaemia episode among those taking SZC compared with no K^+ binder [18]. Odds ratios for maintaining RAASi therapy were 2.02 [95% confidence interval (CI) 1.65–2.46] in the USA, 3.14 (95% CI 2.58–3.82) in Japan and 2.83 (95% CI 1.46–5.46) in Spain for those treated with SZC relative to no K^+ binder treatment.

As retrospective studies, these and similar reports do not provide insights into the thought processes underlying healthcare providers' decision-making. As seen with our prospective data collection, considerable variation in hyperkalaemia management is apparent by country and provider specialty. As follow-up data become available, patient views of their health condition and hyperkalaemia treatment will provide additional insights not obtainable through retrospective analysis. Better understanding of provider and patient views is anticipated to inform health system, professional society and payer efforts to improve the quality of hyperkalaemia care.

The proposed study design has some limitations. Selection of healthcare providers interested in a hyperkalaemia study may introduce bias; the study sought to include a variety of specialties and types of clinical practices to mitigate this risk. Healthcare providers were not required to report their specialty and 30% chose not to do so. The by-specialty differences observed in treatment objectives and management strategies should be interpreted in light of the missing data. Nonetheless, these findings may help professional societies to tailor messages encouraging their members to adopt evidence-based therapies.

Uptake of guideline-directed medical treatment into clinical practice is generally slow [19, 20] and hyperkalaemia management is no exception. Adoption of evidence-based therapies will potentially reduce hyperkalaemia recurrence with associated health risks and resource utilization and facilitate maintenance of optimal RAASi dosing with its established benefits. Understanding the thought processes underpinning providers' management decisions is a necessary prerequisite for identifying and implementing measures to improve the care of patients with hyperkalaemia.

SUPPLEMENTARY DATA

Supplementary data are available at *Clinical Kidney Journal* online.

AUTHORS' CONTRIBUTIONS

NT, MB, AKS, JH contributed to design of the study; HC oversaw data analysis; JH drafted the manuscript; all co-authors provided editorial review and final approval of the manuscript.

DATA AVAILABILITY STATEMENT

The data underlying this article cannot be shared publicly due to privacy laws, such as the General Data Protection Regulation.

CONFLICT OF INTEREST STATEMENT

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19. Nicholas SB, Daratha KB, Alicic RZ *et al*. Prescription of guideline-directed medical therapies in patients with diabetes and chronic kidney disease from the CURE-CKD Registry, 2019–2020. *Diabetes Obes Metab* 2023;**25**:2970–9. https://doi.org/10.1111/dom.15194

20. Shahid I, Khan MS, Fonarow GC *et al*. Bridging gaps and optimizing implementation of guideline-directed medical therapy for heart failure. *Prog Cardiovasc Dis* 2024;**82**:61–9. https://doi.org/10.1016/j.pcad.2024.01.008