

# Getting New Therapies: the Rare Disease Problem

Daniel Gale

St Peter's Chair of Nephrology, University College London

RaDaR Director



## Challenges for rare kidney diseases

- Developing a new therapy is expensive so biotech/pharma/investors need to have a credible pathway to regulatory approval of a potential therapy before risking investment needed to develop and test a treatment in a clinical trial
  - Market size for rare disease therapy is necessarily small
- Regulators need to decide what treatment effect would justify approval
  - Funders (or NICE) need to have evidence that the cost of the drug is commensurate with the benefit to patients and society
- Need clear data on natural history (ie quantify unmet need) to assess benefit (i.e. to balance against known and unknown risks of novel treatments)

## Challenges for rare kidney diseases (2)

- In rare diseases, trials are necessarily small (not enough patients for mega-trials) and duration is short (>2 years not usually feasible)
- Time between established evidence of kidney damage and kidney failure is typically longer than this
  - Limited opportunity to gather safety data so large effect size needed to balance unascertained risks (in addition to those that are known)
  - Intervention usually must be before CKD advanced so trial endpoint cannot be kidney failure event
- A trial showing that proteinuria reduces or eGFR slope flattens is not enough to get a new medicine to patients unless the **likely impact on kidney failure risk has been quantified**
  - The greater the transparency/predictability of approval decisions the more manageable the risk of investing in drug development: engage with stakeholders!

## Federal Drug Administration criteria for approval of new medicines

- In US law, FDA approval is based on a drug showing evidence of efficacy to improve how patients: **Feel, Function or Survive**
  - Because kidney failure is known to be detrimental to function and survival (and often to how patients feel) this is an approvable outcome
- Evidence of how a potential new therapy affects how patients feel is important
  - Need validated tools to assess how people feel
  - Need to quantify how diseases make patient feel before potential impact of a new therapy on this can be appraised

## How RaDaR can advance treatments for rare disease

- **Epidemiology studies**

- Contribution disease makes to societal/healthcare needs important in justifying resource to study it and understanding potential impact of treatment
- Informs feasibility of clinical trials (RaDaR can also help recruitment)

- **Natural history studies**

- Data showing what happens to untreated patients needed to inform rational appraisal of risk/benefit ratio of interventions: patients, clinicians, regulators and funders (NICE) need this information
- Identification and validation of surrogate endpoints to unlock potential for trials
  - Working with industry (individually or as part of PARASOL) helps establish these
- Needed to calculate power of clinical trials (and other aspects of **trial design**)

- **Patient reported experience measures**

- Annual RaDaR surveys



# Outputs so far

- Epidemiology
- Genetic association studies
  - Collaboration with **NIHR | BioResource**
- Retrospective and prospective longitudinal Cohort studies: Natural History, outcomes and clinical practice

**KI REPORTS** 2024  
KIReports.org

**Description and Cross-Sectional Analyses of 25,880 Adults and Children in the UK National Registry of Rare Kidney Diseases Cohort**

Katie Wong<sup>1,2</sup>, David Pitcher<sup>1,2</sup>, Fiona Braddon<sup>1</sup>, Lewis Downward<sup>1</sup>, Retha Steenkamp<sup>5</sup>, Sherry Masoud<sup>1,2</sup>, Nicholas Annear<sup>3</sup>, Jonathan Barratt<sup>4</sup>, Coralie Bingham<sup>1</sup>, Richard J. Coward<sup>1</sup>, Tina Chrysochou<sup>1</sup>, David Game<sup>1</sup>, Sian Griffin<sup>1,6</sup>, Matt Hall<sup>11</sup>, Sally Johnson<sup>12</sup>, Durga Kanigicherla<sup>8</sup>, Fiona Karet Frankl<sup>13</sup>, David Kavanagh<sup>14,15</sup>, Larissa Kerecuk<sup>16</sup>, Eamonn R. Maher<sup>17</sup>, Shabbir Moochhala<sup>17</sup>, Jenny Pinney<sup>18</sup>, John A. Sayer<sup>19</sup>, Roslyn Simms<sup>19</sup>, Smeeta Sinha<sup>20</sup>, Shalabh Srivastava<sup>20</sup>, Frederick W.K. Tam<sup>21</sup>, Kay Thomas<sup>22</sup>, A. Neil Turner<sup>23</sup>, Stephen B. Walsh<sup>2</sup>, Aoife Waters<sup>25</sup>, Patricia Wilson<sup>2</sup>, Edwin Wong<sup>14</sup>, Karla Therese L. Sy<sup>26</sup>, Kui Huang<sup>26</sup>, Jamie Ye<sup>26</sup>, Dorothea Nitsch<sup>1,27</sup>, Moin Saleem<sup>7</sup>, Detlef Bockenhauer<sup>2,28</sup>, Kate Bramham<sup>1,28</sup>, Daniel P. Gale<sup>1,27</sup>, and RaDaR consortium<sup>28</sup>

**Science** 2019

**Germline selection shapes human mitochondrial DNA diversity**

WEI WEI<sup>1</sup>, SALIH TUNA<sup>2</sup>, MICHAEL J. KEOGH<sup>3</sup>, KATHERINE R. SMITH<sup>4</sup>, TIMOTHY J. AITMAN<sup>5</sup>, PHIL L. BEALES<sup>6</sup>, DAVID L. BENNETT<sup>7</sup>, DANIEL P. GALE<sup>8</sup>

MARIA A. K. BITNER-GLINDZICZ [..] PATRICK F. CHINNERY [..] +32 authors Authors Info & Affiliations

**Article** 2020 **nature**

**Whole-genome sequencing of patients with rare diseases in a national health system**

Ernest Turro<sup>1,2,3,4</sup>, William J. Astle<sup>5,6</sup>, Karyn Megy<sup>7</sup>, Stefan Graf<sup>2,3,5</sup>, Daniel Greene<sup>1,8</sup>, Olga Shomardina<sup>1</sup>, Hana Lango Allen<sup>9</sup>, Alba Sanchez-Juan<sup>10</sup>, Mottia Frontini<sup>11,12</sup>, Chantal Thyse<sup>13</sup>, Jonathan Stephens<sup>14</sup>, Rutendo Mapepa<sup>15</sup>, Oliver S. Burren<sup>16</sup>, Kate Downes<sup>17</sup>, Matthias Haime<sup>18,19</sup>, Salih Tuna<sup>20</sup>, Sri V. V. Deevi<sup>21</sup>, Timothy J. Aitman<sup>22</sup>, David L. Bennett<sup>23,24</sup>, Paul Calleja<sup>25</sup>, Keren Cars<sup>26</sup>, Mark J. Caulfield<sup>14,25</sup>, Patrick F. Chinnery<sup>13,27</sup>, Peter H. Dixon<sup>28</sup>, Daniel P. Gale<sup>14,29</sup>, Roger James<sup>30</sup>, Anja Kozzell<sup>17,31</sup>, Michael A. Laffan<sup>32,33</sup>, Adam P. Levine<sup>34</sup>

Received: 23 December 2018  
Accepted: 5 May 2020  
Published online: 24 June 2020

**BASIC RESEARCH** **JASN** 2020

**Large-Scale Whole-Genome Sequencing Reveals the Genetic Architecture of Primary Membranoproliferative GN and C3 Glomerulopathy**

Adam P. Levine<sup>1</sup>, Melanie M.Y. Chan<sup>1</sup>, Omid Sadeghi-Alavijeh<sup>1</sup>, Edwin K.S. Wong<sup>2,3,4</sup>, H. Terence Cook<sup>5</sup>, Sofie Ashford<sup>6</sup>, Keren Cars<sup>5,7</sup>, Martin T. Christian<sup>8</sup>, Matthew Hall<sup>9</sup>, Claire Louise Harris<sup>10</sup>, Paul McAlinden<sup>7</sup>, Kevin J. Marchbank<sup>11</sup>, Stephen D. Marks<sup>12</sup>, Heather Maxwell<sup>11</sup>, Karyn Megy<sup>13</sup>, Christopher J. Penkett<sup>5,7</sup>, Monika Mozere<sup>1</sup>, Kathleen E. Stirrups<sup>5,7</sup>, Salih Tuna<sup>14</sup>, Julie Wessels<sup>12</sup>, Deborah Whitehorn<sup>5,7</sup>, MPGN/DDD/C3 Glomerulopathy Rare Disease Group<sup>14</sup>, NIHR BioResource<sup>5</sup>

**CJASN** Editor's Pick 2023

**ORIGINAL ARTICLE: CHRONIC KIDNEY DISEASE**

**Long-Term Outcomes in IgA Nephropathy**

Pitcher, David BSc<sup>1,2</sup>; Braddon, Fiona BSc<sup>1</sup>; Hendry, Bruce PhD<sup>3</sup>; Mercer, Alex PhD<sup>4</sup>; Osmaston, Kate BA<sup>1</sup>; Saleem, Moin A. PhD<sup>5</sup>; Steenkamp, Retha PhD<sup>1</sup>; Wong, Katie MBBS<sup>1,2</sup>; Turner, A. Neil PhD<sup>6</sup>; Wang, Kaijun PhD<sup>3</sup>; Gale, Daniel P. PhD<sup>2</sup>; Barratt, Jonathan PhD<sup>7,8</sup>

Articles 2024 **THE LANCET**

**Effects of rare kidney diseases on kidney failure: a longitudinal analysis of the UK National Registry of Rare Kidney Diseases (RaDaR) cohort**

Katie Wong, David Pitcher, Fiona Braddon, Lewis Downward, Retha Steenkamp, Nicholas Annear, Jonathan Barratt, Coralie Bingham, Constantina Chrysochou, Richard J Coward, David Game, Sian Griffin, Matt Hall, Sally Johnson, Durga Kanigicherla, Fiona Karet Frankl, David Kavanagh, Larissa Kerecuk, Eamonn R Maher, Shabbir Moochhala, Jenny Pinney, John A Sayer, Roslyn Simms, Smeeta Sinha, Shalabh Srivastava, Frederick W K Tam, Andrew Neil Turner, Stephen B Walsh, Aoife Waters, Patricia Wilson, Edwin Wong, Christopher Mark Taylor, Dorothea Nitsch, Moin Saleem, Detlef Bockenhauer, Kate Bramham, Daniel P Gale, for the RaDaR consortium\*

**medRxiv** Cold Spring Harbor Laboratory **BMJ** Yale 2024

**THE PREPRINT SERVER FOR HEALTH SCIENCES**

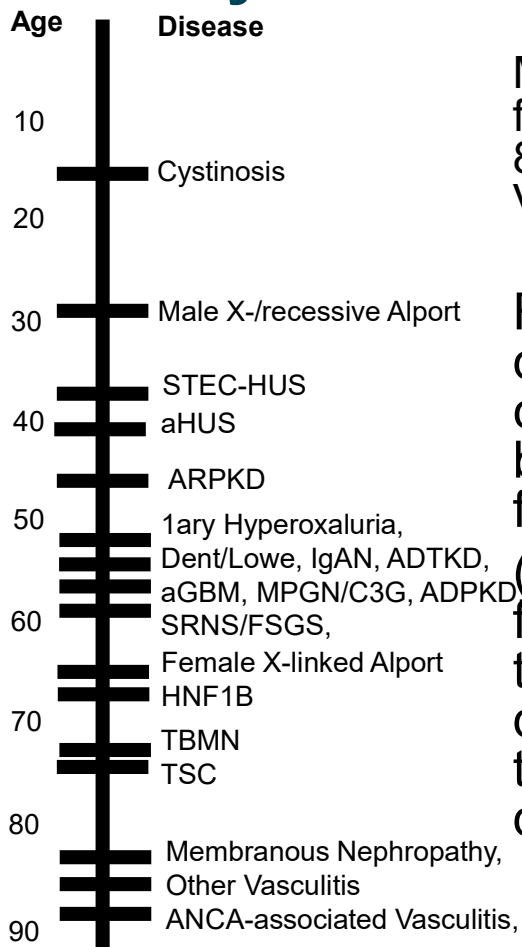
**Clinical Predictors of Long-term Outcomes in C3 Glomerulopathy and Immune-Complex Membranoproliferative Glomerulonephritis within the UK RaDaR Registry**

Sherry Masoud, Katie Wong, Lewis Downward, David Pitcher, Nicholas J.A. Webb, Clare Proudfoot, RaDaR Consortium, Edwin K.S. Wong, Daniel P. Gale

• <https://ukkidney.org/rare-renal/research-rare-renal>



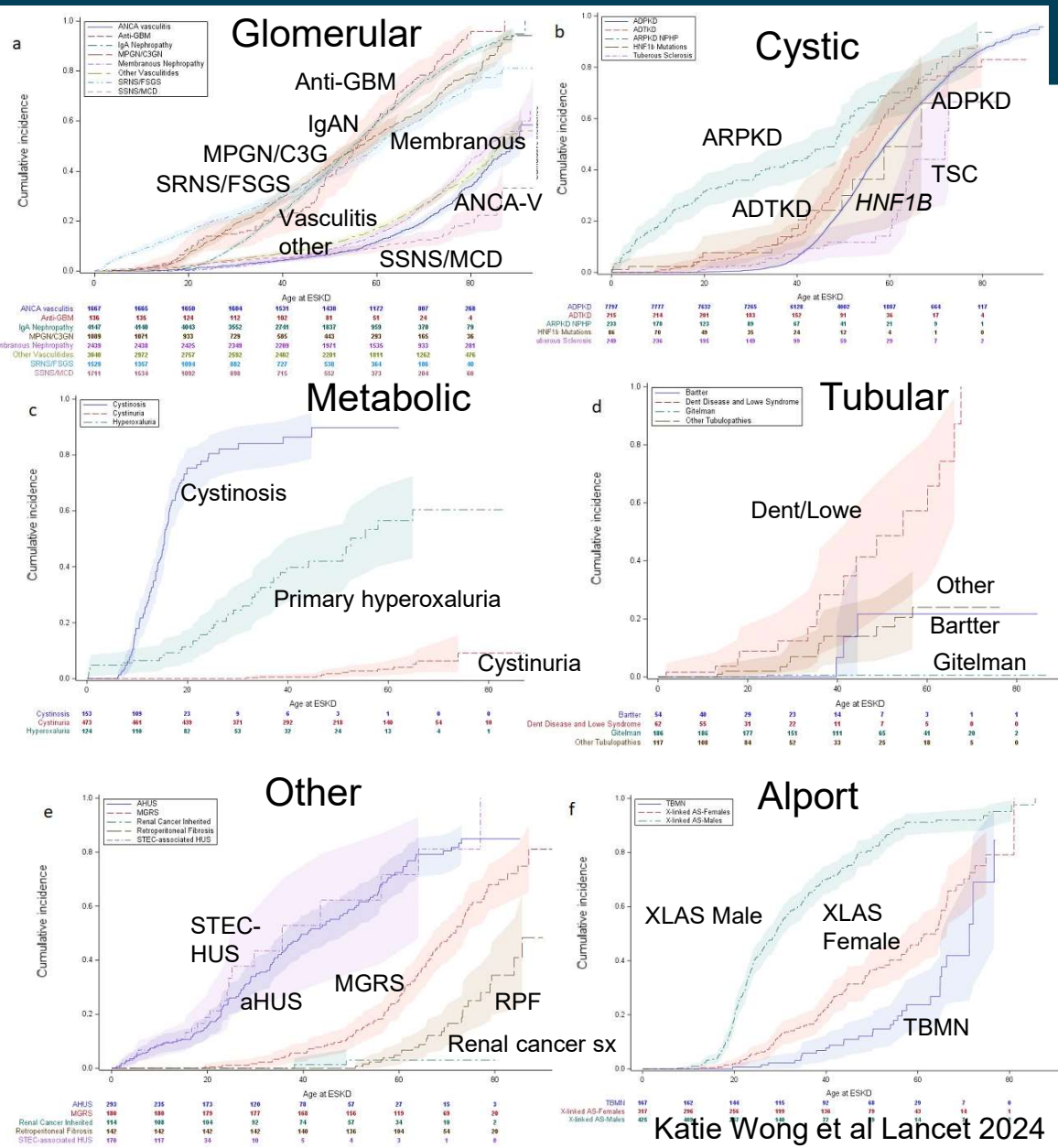
# Renal outcomes in Rare Kidney Disease Groups



Median age at KF ranges from 15 for Cystinosis to 89 for ANCA-associated Vasculitis

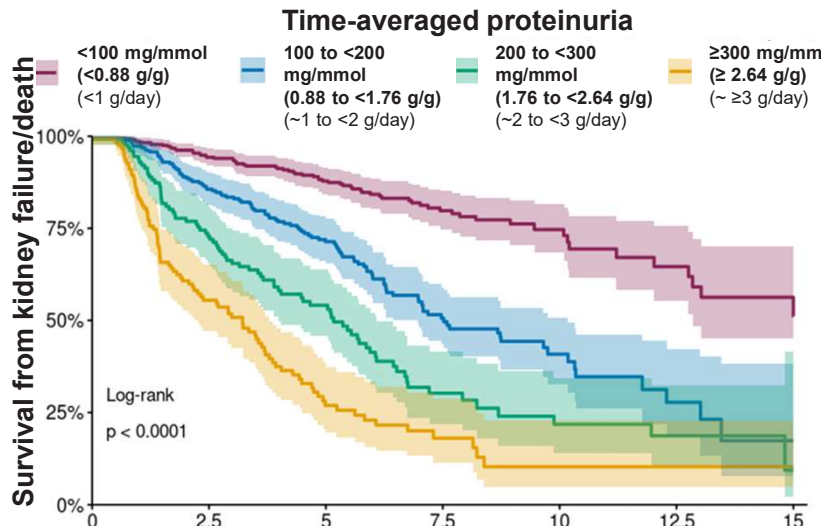
Rare diseases make disproportionate contribution to overall burden of kidney failure

(effective treatments for "CKD" less likely to impact on RRT demand than those targeting rare kidney disease)



# IgA nephropathy

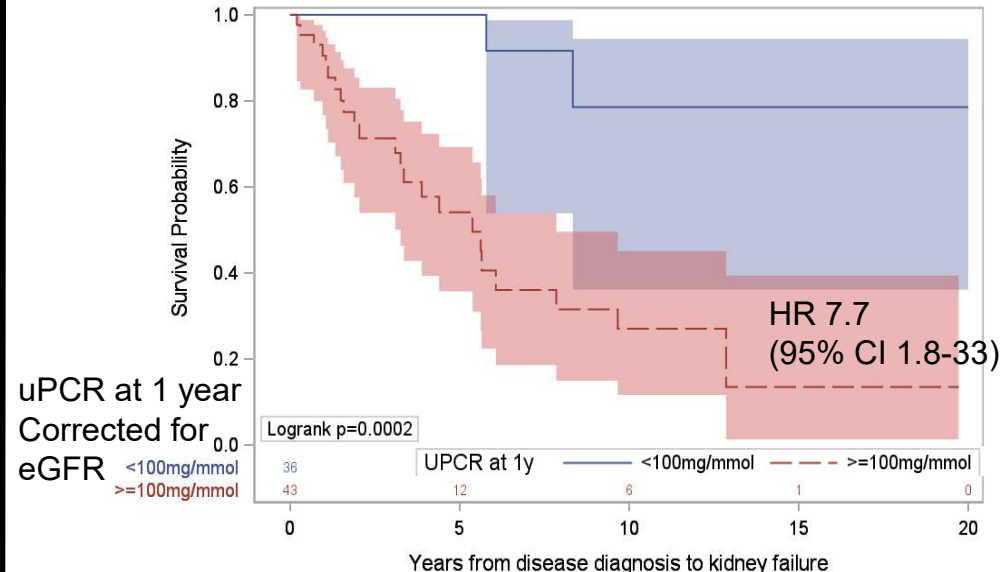
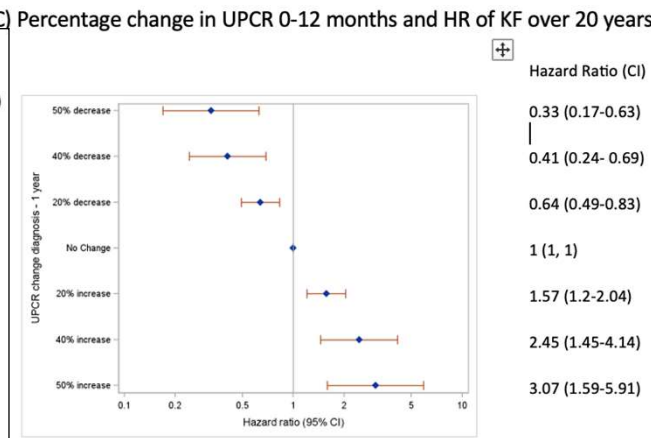
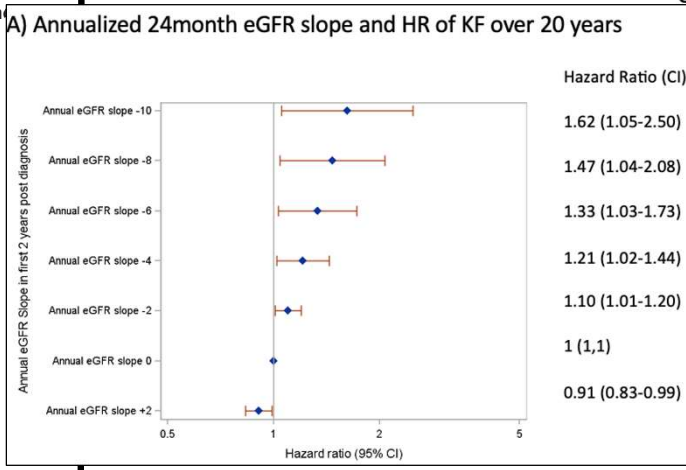
# C3 Glomerulopathy/IC-MPGN



mg/mmol	Time to kidney failure/death event (years)						
<math><100</math>	406	336	217	103	46	24	9
100 to <math><200</math>	262	204	126	54	21	8	2
200 to <math><300</math>	129	89	49	18	10	4	1
>math>\geq 300</math>	123	60	22	8	1	1	1

Time-averaged proteinuria	eGFR slope (mL/min/1.73 m <sup>2</sup> /year)			Kidney failure/death risk		
	N	Mean	SD	N	HR	95% CI
<math><100</math> mg/mmol	385	-0.35	7.15	405	Ref	Ref
100 to <math><200</math> mg/mmol	247	-3.32	10.09	264	2.83	2.09–3.82
200 to <math><300</math> mg/mmol	113	-6.67	5.73	128	4.82	3.49–6.66
>math>\geq 300</math> mg/mmol	111	-12.41	11.28	126	9.00	6.56–12.34

Pitcher D, et al. CJASN 2023



Could trial showing efficacy at achieving <math><1</math>g/day proteinuria result in full FDA approval? **Needs replication!**





# Establishing clinical trial endpoints: Working with International Society of Glomerular Diseases, FDA, EMA, NephCure and others

- PARASOL:



PARASOL is a collaborative international effort that aims to define the quantitative relationships between short-term changes in biomarkers (proteinuria and GFR) and long-term outcomes in order to support the use of alternative proteinuria-based endpoints as a basis for accelerated and traditional approval.

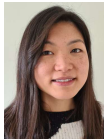
The PARASOL group will achieve this in 2024 by conducting a large-scale analysis of existing data from patients of all ages with FSGS who are participants in observational cohort studies, regional or national registries, or real-world data sets.

<https://www.is-gd.org/parasol>

- Initial project in FSGS will report at the ASN in October 2024
  - 26 registries from numerous countries involved – RaDaR is by far the largest
  - Future projects will target other glomerular diseases (Alport, C3G etc)

# Acknowledgements

## Participants and their families Clinical staff at participating hospitals



Katie Wong (RaDaR Renal Fellow)



David Pitcher (RaDaR Statistician)

Sherry Masoud (RaDaR Renal Fellow)



Fiona Braddon

Garry King

Lewis Downard

Kate Osmaston

Andrew Atterton

Zoe Plummer

Retha Steenkamp

Kate Bramham



Sharirose Abat<sup>1</sup>, Shazia Adalat<sup>2</sup>, Joy Agbonmwandolor<sup>3</sup>, Zubaidah Ahmad<sup>4</sup>, Abdulfattah Alejmi<sup>5</sup>, Rashid Almasarwah<sup>6</sup>, Nicholas Annear<sup>1</sup>, Ellie Asgari<sup>4</sup>, Amanda Ayers<sup>7</sup>, Jyoti Baharan<sup>8</sup>, Gowrie Balasubramaniam<sup>9</sup>, Felix Jo-Bamba Kpodo<sup>10</sup>, Tarun Bansal<sup>11</sup>, Alison Barratt<sup>12</sup>, Jonathan Barratt<sup>79</sup>, Megan Bates<sup>13</sup>, Natalie Bayne<sup>14</sup>, Janet Bendle<sup>15</sup>, Sarah Benyon<sup>16</sup>, Carsten Bergmann<sup>17, 18</sup>, Sunil Bhandari<sup>19</sup>, Coralie Bingham<sup>20</sup>, Preetnam Boddana<sup>21</sup>, Sally Bond<sup>22</sup>, Fiona Braddon<sup>23</sup>, Kate Bramham<sup>23</sup>, Angela Branson<sup>15</sup>, Stephen Brearey<sup>24</sup>, Vicky Brocklebank<sup>25</sup>, Sharaniit Budwa<sup>126</sup>, Conor Byrne<sup>27</sup>, Hugh Cairns<sup>28</sup>, Brian Camilleri<sup>29</sup>, Gary Campbell<sup>30</sup>, Alys Capell<sup>31</sup>, Margaret Carmody<sup>8</sup>, Marion Carson<sup>32</sup>, Tracy Cathcart<sup>19</sup>, Christine Catley<sup>9</sup>, Karine Cesar<sup>33</sup>, Houda Chea<sup>15</sup>, James Chess<sup>34</sup>, Chee Kay Cheung<sup>26</sup>, Katy-Jane Chick<sup>35</sup>, Nihil Chitalia<sup>36</sup>, Martin Christian<sup>37</sup>, Tina Chrysochou<sup>38, 39</sup>, Katherine Clark<sup>40</sup>, Christopher Clayton<sup>41</sup>, Rhian Clissold<sup>20</sup>, Helen Cockerill<sup>33</sup>, Joshua Coelhoe<sup>42</sup>, Elizabeth Colby<sup>43</sup>, Viv Colclough<sup>44</sup>, Eileen Conway<sup>45</sup>, H. Terence Cook<sup>46</sup>, Wendy Cook<sup>47</sup>, Theresa Cooper<sup>48</sup>, Richard J Coward<sup>43</sup>, Sarah Crosbie<sup>22</sup>, Gabor Cserep<sup>49</sup>, Anjali Date<sup>50</sup>, Katherine Davidson<sup>48</sup>, Amanda Davies<sup>51</sup>, Neeraj Dhaun<sup>52</sup>, Ajay Dhaygude<sup>53</sup>, Lynn Diskin<sup>12</sup>, Abhijit Dixit<sup>41, 54</sup>, Eunice Ann Doctolero<sup>35</sup>, Suzannah Dorey<sup>55</sup>, Lewis Downard<sup>23</sup>, Mark Drayson<sup>56</sup>, Gavin Dreyer<sup>27</sup>, Tina Dutt<sup>57</sup>, Kufreabasi Etuk<sup>28</sup>, Dawn Evans<sup>58</sup>, Jenny Finch<sup>29</sup>, Frances Flinter<sup>59</sup>, James Fotheringham<sup>60</sup>, Daniel P. Gale<sup>61</sup>, Hugh Gallagher<sup>62</sup>, David Game<sup>4</sup>, Eva Lozano Garcia<sup>42</sup>, Madita Gavrila<sup>22</sup>, Susie Gear<sup>63</sup>, Colin Geddes<sup>64</sup>, Mark Gilchrist<sup>65</sup>, Matt Gittus<sup>66</sup>, Paraskevi Goggolidou<sup>67</sup>, Christopher Goldsmith<sup>57</sup>, Patricia Gooden<sup>68</sup>, Andrea Goodlife<sup>26</sup>, Priyanka Goodwin<sup>53</sup>, Tassos Grammatikopoulos<sup>28, 69</sup>, Barry Gray<sup>70</sup>, Megan Griffith<sup>74</sup>, Steph Gumus<sup>9</sup>, Sanjana Gupta<sup>71</sup>, Patrick Hamilton<sup>72</sup>, Lorraine Harper<sup>56</sup>, Tess Harris<sup>73</sup>, Louise Haskell<sup>74</sup>, Samantha Hayward<sup>43</sup>, Shivaram Hegde<sup>75</sup>, Bruce Hendry<sup>76</sup>, Sue Hewins<sup>77</sup>, Nicola Hewitson<sup>78</sup>, Kate Hillman<sup>15</sup>, Mritunjay Hiremath<sup>57</sup>, Alexandra Howson<sup>79</sup>, Zay Htet<sup>28</sup>, Sharon Huish<sup>16</sup>, Richard Hull<sup>1</sup>, Alister Humphries<sup>68</sup>, Karl Hunter<sup>80</sup>, Samantha Hunter<sup>19</sup>, Marilyn Ijeomah-Orji<sup>6</sup>, Nick Inston<sup>81</sup>, David Jayne<sup>82</sup>, Gbemisola Jenfa<sup>31</sup>, Alison Jenkins<sup>83</sup>, Sally Johnson<sup>118</sup>, Caroline A Jones<sup>84</sup>, Colin Jones<sup>85</sup>, Amanda Jones<sup>5</sup>, Lavanya Kamesh<sup>81</sup>, Durga Kanigicherla<sup>39</sup>, Fiona Karet Frank<sup>82</sup>, Mahzuz Karim<sup>86</sup>, Amrit Kaur<sup>87</sup>, David Kavanagh<sup>25</sup>, Kelly Kearley<sup>88</sup>, Larissa Kerecuk<sup>14</sup>, Arif Khwaja<sup>70</sup>, Garry King<sup>23</sup>, Grant King<sup>89</sup>, Ewa Kisłowska<sup>4</sup>, Edyta Klata<sup>29</sup>, Maria Kokocinska<sup>14</sup>, Mark Lambie<sup>90</sup>, Laura Lawless<sup>41</sup>, Thomas Ledson<sup>80</sup>, Rachel Lennon<sup>91</sup>, Adam P Levine<sup>92</sup>, Ling Wai Maggie Lai<sup>16</sup>, Graham Lipkin<sup>81</sup>, Graham Lovitt<sup>93</sup>, Paul Lyons<sup>94</sup>, Holly Mabillard<sup>95</sup>, Katherine Mackintosh<sup>7</sup>, Khalid Mahdi<sup>96</sup>, Eamonn Maher<sup>97</sup>, Kevin J. Marchbank<sup>25</sup>, Patrick B Mark<sup>64</sup>, Bridgett Masunda<sup>9</sup>, Zainab Mavani<sup>31</sup>, Jake Mayfair<sup>4</sup>, Joanna Mckinnell<sup>98</sup>, Nabil Melhem<sup>2</sup>, Simon Meyrick<sup>51</sup>, Shabbir Moochhal<sup>61</sup>, Putnam Morgan<sup>99</sup>, Ann Morgan<sup>100, 101</sup>, Fawad Muhammad<sup>5</sup>, Shona Murray<sup>30</sup>, Kristina Novobritskaya<sup>22</sup>, Albert CM Ong<sup>66, 70</sup>, Louise Oni<sup>102</sup>, Kate Osmaston<sup>23</sup>, Neal Padmanabhan<sup>64</sup>, Sharon Parkes<sup>14</sup>, Jean Patrick<sup>7</sup>, James Pattison<sup>4</sup>, Riny Paul<sup>1</sup>, Rachel Percival<sup>103</sup>, Stephen J. Perkins<sup>104</sup>, Alexandre Persu<sup>105, 106</sup>, William G Petchey<sup>107</sup>, Matthew Caleb Pickering<sup>46</sup>, Jennifer Pinney<sup>81</sup>, David Pitcher<sup>23</sup>, Lucy Plumb<sup>43</sup>, Zoe Plummer<sup>23</sup>, Joyce Popoola<sup>1</sup>, Frank Post<sup>28</sup>, Albert Power<sup>83</sup>, Guy Pratt<sup>56</sup>, Charles Pusey<sup>46</sup>, Ria Rabara<sup>22</sup>, May Rabuya<sup>4</sup>, Tina Raju<sup>42</sup>, Chadd Javier<sup>108</sup>, Ian SD Roberts<sup>22</sup>, Candice Roufousse<sup>109</sup>, Adam Rumjon<sup>28</sup>, Moin Saleem<sup>43</sup>, RN Sandford<sup>97</sup>, Karwaljit S. Sandu<sup>110</sup>, Nadia Sarween<sup>81</sup>, John Sayer<sup>95</sup>, Neil Sebire<sup>111, 112</sup>, Haresh Selvakandan<sup>26</sup>, Ashesh Sharma<sup>57</sup>, Edward J Sharples<sup>22</sup>, Neil Sheerin<sup>25</sup>, Harish Shetty<sup>53</sup>, Rukshana Shroff<sup>12</sup>, Roslyn Simms<sup>70</sup>, Manish Sinha<sup>2</sup>, Smeeta Sinha<sup>113</sup>, Kerry Smith<sup>29</sup>, Lara Smith<sup>15</sup>, Shalabh Srivastava<sup>114</sup>, Retha Steenkamp<sup>23</sup>, Ian Stott<sup>115</sup>, Katerina Stroud<sup>97</sup>, Pauline Swift<sup>42</sup>, Justyna Szklarzewicz<sup>26</sup>, Fred Tam<sup>46</sup>, Kay Tan<sup>116</sup>, Robert Taylor<sup>117</sup>, Marc Tischkowitz<sup>97</sup>, Vincent Tse<sup>118</sup>, Alison Turnbull<sup>85</sup>, A Neil Turner<sup>119</sup>, Kay Tyerman<sup>55</sup>, Miranda Usher<sup>120</sup>, Gopalakrishnan Venkat-Raman<sup>121</sup>, Alyson Walker<sup>122</sup>, Stephen B. Walsh<sup>61</sup>, Aoife Waters<sup>123</sup>, Angela Watt<sup>68</sup>, Phil Webster<sup>6</sup>, Ashutosh Wechalekar<sup>124</sup>, Gavin Iain Welsh<sup>43</sup>, Nicol West<sup>125</sup>, David Wheeler<sup>61</sup>, Lisa Willcocks<sup>107</sup>, Angharad Williams<sup>33</sup>, Emma Williams<sup>29</sup>, Karen Williams<sup>4</sup>, Deborah H Wilson<sup>126</sup>, Patricia D Wilson<sup>127</sup>, Paul Winyard<sup>9</sup>, Edwin Wong<sup>25</sup>, Katie Wong<sup>23</sup>, Grahame Wood<sup>58</sup>, Emma Woodward<sup>15</sup>, Len Woodward<sup>128</sup>, Adrian Woolf<sup>129</sup>, David Wright<sup>71</sup>

<sup>1</sup> George's University Hospitals NHS Foundation Trust, UK  
<sup>2</sup> Evelina London Children's Hospital, UK  
<sup>3</sup> David Evans Medical Research Centre, Nottingham University Hospital NHS Trust, UK  
<sup>4</sup> Guy's and St Thomas NHS Foundation Trust, UK  
<sup>5</sup> Yashwantrao Chavan Maharashtra Sahakar Nigam, India  
<sup>6</sup> Imperial College Healthcare NHS Trust, UK  
<sup>7</sup> James Paget University Hospital NHS Foundation Trust, UK  
<sup>8</sup> Heart of England NHS Foundation Trust, Birmingham, UK  
<sup>9</sup> Mid and South Essex NHS Foundation Trust, UK  
<sup>10</sup> Royal Berkshire NHS Foundation Trust, UK  
<sup>11</sup> Bradford Teaching Hospitals NHS Foundation Trust, UK  
<sup>12</sup> Royal United Hospital Bath NHS Trust, UK  
<sup>13</sup> Freeman Hospital, Newcastle upon Tyne, UK  
<sup>14</sup> Birmingham Women's and Children's NHS Foundation Trust, UK  
<sup>15</sup> Manchester University NHS Foundation Trust, UK  
<sup>16</sup> Royal Devon University Healthcare NHS Foundation Trust, UK  
<sup>17</sup> Medicalische Goggo Marz, Mainz, Germany  
<sup>18</sup> Department of Medicine, Faculty of Medicine, Medical College of Freiburg, Freiburg, Germany  
<sup>19</sup> Hull University Teaching Hospitals NHS Trust, UK  
<sup>20</sup> Queen's Kidney Unit, Royal Devon University Healthcare NHS Foundation Trust, UK  
<sup>21</sup> Gloucestershire Hospitals NHS Foundation Trust, UK  
<sup>22</sup> Oxford University Hospitals NHS Foundation Trust, UK  
<sup>23</sup> UK Kidney Association, UK  
<sup>24</sup> Newcastle upon Tyne Hospitals NHS Foundation Trust, UK  
<sup>25</sup> Newcastle upon Tyne Hospitals NHS Foundation Trust, Newcastle upon Tyne, UK  
<sup>26</sup> St George's Hospital NHS Trust, London, UK  
<sup>27</sup> King's College Hospital NHS Foundation Trust, UK  
<sup>28</sup> East Suffolk and North Essex NHS Foundation Trust, UK  
<sup>29</sup> Newcastle upon Tyne Hospitals NHS Foundation Trust, Newcastle upon Tyne, UK  
<sup>30</sup> Freeman Hospital, Newcastle upon Tyne, UK  
<sup>31</sup> Northern Health and Social Care Trust and Northern Ireland Clinical Research Network  
<sup>32</sup> North West Anglia NHS Foundation Trust, UK  
<sup>33</sup> Morriston Hospital, Swansea Bay Health Board, UK  
<sup>34</sup> Oxford and Gwentham NHS Trust, UK  
<sup>35</sup> Nottingham Children's Hospital NHS Foundation Trust, UK  
<sup>36</sup> Salford Royal Hospital, Northern Care Alliance NHS Foundation Trust, Salford, UK  
<sup>37</sup> King's College London, UK  
<sup>38</sup> Nottingham University Hospitals NHS Trust, UK  
<sup>39</sup> Epsom and St Helier University Hospitals NHS Trust, UK  
<sup>40</sup> University of Bristol Medical School, Bristol, UK  
<sup>41</sup> Royal Stoke NHS Foundation Trust, UK  
<sup>42</sup> Manchester Royal Infirmary, UK  
<sup>43</sup> Centre for Inflammatory Disease, Imperial College London, UK  
<sup>44</sup> Neurotic Syndrome Trust (NST), UK  
<sup>45</sup> Northumbria Integrated Care NHS Foundation Trust, UK  
<sup>46</sup> Colchester General Hospital, UK  
<sup>47</sup> Newcastle and Gateshead Integrated Care NHS Foundation Trust, UK  
<sup>48</sup> University of Birmingham, UK  
<sup>49</sup> Liverpool University Hospitals Foundation NHS Trust, UK  
<sup>50</sup> Department of Clinical Genetics, Guy and St Thomas' NHS Foundation Trust, UK  
<sup>51</sup> Centre for Health and Related Research, School of Population Health, University of Sheffield, UK  
<sup>52</sup> Research Department of Renal Medicine, Royal Free Hospital, UK  
<sup>53</sup> Guy Thomas Renal Unit, Epsom and St Helier University Hospitals NHS Trust, UK  
<sup>54</sup> Report UK, UK  
<sup>55</sup> Queen Elizabeth University Hospital, Glasgow, UK  
<sup>56</sup> College of Medicine and Dentistry, University of Essex, UK  
<sup>57</sup> Division of Population Health, University of Sheffield, UK  
<sup>58</sup> University of Wolverhampton, UK  
<sup>59</sup> Patient Representative, UK  
<sup>60</sup> Institute of Liver Studies, King's College London, UK  
<sup>61</sup> Sheffield Kidney Institute, Sheffield Teaching Hospitals NHS Foundation Trust, UK  
<sup>62</sup> Royal Free Hospital, UK  
<sup>63</sup> Manchester Institute of Nephrology and Transplantation, Manchester Royal Infirmary, UK  
<sup>64</sup> NED Charity, UK  
<sup>65</sup> University Hospital Southampton NHS Foundation Trust, UK  
<sup>66</sup> Children's Kidney Centre, University Hospital of Wales, UK  
<sup>67</sup> Travers Therapeutics, UK  
<sup>68</sup> University Hospitals Coventry and Warwickshire NHS Trust, UK  
<sup>69</sup> County Durham & Darlington NHS Foundation Trust, UK  
<sup>70</sup> University of Leicester, UK  
<sup>71</sup> Niral University Teaching Hospital NHS Foundation Trust, UK  
<sup>72</sup> University Hospitals Birmingham NHS Foundation Trust, UK  
<sup>73</sup> Department of Medicine, University of Cambridge, UK  
<sup>74</sup> North Bristol NHS Trust, UK  
<sup>75</sup> Alder Hey Children's NHS Foundation Trust, UK  
<sup>76</sup> York & Scarborough Teaching Hospitals NHS Foundation Trust, UK  
<sup>77</sup> Norfolk and Norwich University Hospitals NHS Trust, UK  
<sup>78</sup> Royal Manchester Children's Hospital, Manchester, UK  
<sup>79</sup> PFEN UK and Ireland Patient Group  
<sup>80</sup> NIP Support Group, UK  
<sup>81</sup> School of Medicine, St George's University, UK  
<sup>82</sup> Wellcome Centre for Cell-Matrix Research, University of Manchester, UK  
<sup>83</sup> Research Department of Pathology, University College London, UK  
<sup>84</sup> ELBRC Foundation, UK  
<sup>85</sup> Cambridge Institute of Therapeutic Immunology and Infectious Disease, Cambridge, UK  
<sup>86</sup> Newcastle University, UK  
<sup>87</sup> United Lincolnshire Hospitals NHS Trust, UK  
<sup>88</sup> Department of Medical Genetics, University of Cambridge, UK  
<sup>89</sup> University Hospitals of Derby and Burton NHS Foundation Trust, UK  
<sup>90</sup> Metagenetomical Fibrosis (MF) Group, UK  
<sup>91</sup> National Institute of Health and Care Research Leeds Biomedical Research Centre, Leeds Teaching Hospitals NHS Trust, UK  
<sup>92</sup> University of Liverpool, UK  
<sup>93</sup> Newcastle upon Tyne Hospitals NHS Foundation Trust, UK  
<sup>94</sup> Research Department of Structural and Molecular Biology, University College London, UK  
<sup>95</sup> Division of Cardiology, Ghent University Hospital, Ghent, Belgium  
<sup>96</sup> Pole of Cardiovascular Research, Institut de Recherche Expérimentale et Clinique, Université Catholique de Louvain, Brussels, Belgium  
<sup>97</sup> Cambridge Institute of Therapeutic Immunology and Infectious Disease, Cambridge, UK  
<sup>98</sup> East and North Hertfordshire NHS Trust, UK  
<sup>99</sup> Department of Immunology and Transplantation, Faculty of Medicine, Imperial College London, UK  
<sup>100</sup> Othman and Telford Hospital NHS Trust, UK  
<sup>101</sup> National Institute of Health and Care Research Great Ormond Street Hospital Biomedical Research Centre, UK  
<sup>102</sup> UCL Great Ormond Street Institute of Child Health, UK  
<sup>103</sup> Southern Care Alliance NHS Foundation Trust, UK  
<sup>104</sup> North Yorkshire and Sunderland NHS Foundation Trust, UK  
<sup>105</sup> Doncaster and Basethwaite Teaching Hospitals, UK  
<sup>106</sup> Institute of Child Health, Manchester, UK  
<sup>107</sup> Wellcome Centre for Mitochondrial Research, Translational & Clinical Research Institute, Faculty of Health Sciences, University of Manchester, UK  
<sup>108</sup> University of Edinburgh, UK  
<sup>109</sup> Calderdale & Huddersfield NHS Foundation Trust, UK  
<sup>110</sup> Royal Surrey County Hospital, Guildford, UK  
<sup>111</sup> South Tees Hospitals NHS Foundation Trust, UK  
<sup>112</sup> University College Cork, Ireland  
<sup>113</sup> National Institute of Health and Care Research Great Ormond Street Hospital Biomedical Research Centre, UK  
<sup>114</sup> Great Western Hospital, Swindon, UK  
<sup>115</sup> Norfolk and Norwich University Hospitals NHS Foundation Trust, UK  
<sup>116</sup> University College London, UK  
<sup>117</sup> Health Alliance, UK  
<sup>118</sup> School of Biological Sciences, University of Manchester, UK



<https://rarerenal.org>  
[d.gale@ucl.ac.uk](mailto:d.gale@ucl.ac.uk)

