

## **Appendix**

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Appendix Table 1: Pre-specified study outcomes

## **Appendix Figure 1: Medline search strategy**

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

Search Strategy:

- 
- 1 exp Disease Management/ (24144)
  - 2 exp Patient Care Planning/ (49063)
  - 3 exp Primary Health Care/ (71227)
  - 4 exp Progressive Patient Care/ (1155)
  - 5 exp "Delivery of Health Care, Integrated"/ (7618)
  - 6 exp Health Services Accessibility/ (77145)
  - 7 exp Managed Care Programs/ (38305)
  - 8 exp Product Line Management/ (1487)
  - 9 exp Patient Care Team/ (51145)
  - 10 exp Behavior Control/ (10687)
  - 11 exp Counseling/ (30625)
  - 12 exp Health Promotion/ (48415)
  - 13 exp Patient Compliance/ (48094)
  - 14 exp After-Hours Care/ (836)
  - 15 exp "Organization and Administration"/ (989571)
  - 16 ((coordination or coordinated or multifactorial or multi-factorial or multicomponent or multi-component or multidisciplinary or multi-disciplinary or interdisciplinary or inter-disciplinary or integrated or community-based or organized) and (care or approach\* or intervention\* or strategy or strategies or management or managing or center\* or centre\* or clinic\*)).ti. (15814)
  - 17 ("disease management" or "case management").ti. (4921)
  - 18 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 (1280401)
  - 19 exp "Quality of Health Care"/ (4495888)
  - 20 exp Quality Control/ (38176)
  - 21 ((quality or system\* or process\*) adj6 (improvement\* or initiative\* or innovation\* or management or intervention\* or strategy or strategies or program\* or enhance\*)).ab,ti. (154363)
  - 22 (TQM or CQI).ti. (499)
  - 23 19 or 20 or 21 or 22 (4595188)
  - 24 exp Education, Continuing/ (51255)
  - 25 (education and continuing and (medical or professional\* or nursing or physician\* or nurse\*)).ti. (3788)
  - 26 (outreach and (visit\* or education)).ti. (155)
  - 27 (academic and detailing).ti. (83)
  - 28 24 or 25 or 26 or 27 (51742)
  - 29 exp "Diffusion of Innovation"/ (14097)
  - 30 ((diffusion or transfer) and (innovation\* or technology or technologies)).ti. (782)
  - 31 29 or 30 (14469)
  - 32 exp Medical Audit/ (14097)
  - 33 (audit or feedback or compliance or adherence or training).ti. (120762)

34 (improvement\* or improving or improves or improve or guideline\* or practice\* or medical  
or provider\* or physician\* or nurse\* or clinician\* or academic or visit\*).ti. (679159)  
35 exp Practice Guideline/ (17303)  
36 34 or 35 (686997)  
37 33 and 36 (19216)  
38 exp Reminder Systems/ (1946)  
39 reminder\*.ti. (1254)  
40 ((financial or economic or physician\* or patient) and incentive\*).ti. (844)  
41 exp Reimbursement Mechanisms/ (29217)  
42 "pay-for-performance".tw. (1150)  
43 32 or 37 or 38 or 39 or 40 or 41 or 42 (64495)  
44 exp Medical Informatics/ (285746)  
45 (computer or computers).ti. (42749)  
46 (decision and support).ti. (2713)  
47 exp Telemedicine/ (13881)  
48 (telemedicine or telecommunication\*).ti. (3944)  
49 exp Internet/ (43509)  
50 (web or modem or telephone\*).ti. (14879)  
51 exp Telephone/ (12076)  
52 exp Hospital Information Systems/ (24883)  
53 exp Decision Support Systems, Clinical/ (4219)  
54 exp Drug Therapy, Computer-Assisted/ (1330)  
55 exp Clinical Pharmacy Information Systems/ (1057)  
56 exp Medical Records Systems, Computerized/ (22191)  
57 ((computerized or computerised or computer or computer-based) and (order\* or entry)).ti.  
(633)  
58 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 (376017)  
59 18 or 23 or 28 or 31 or 43 or 58 (5330591)  
60 New England Journal of Medicine.nj. or JAMA.jn. or Journal of the American Medical  
Association.nj. or Annals of Internal Medicine.nj. or American journal of medicine.nj. or  
Archives of internal medicine.nj. or Journal of general internal medicine.nj. or BMJ.jn. or British  
Medical Journal.nj. or Lancet.nj. or Canadian medical association journal.nj. or Archives of  
family medicine.nj. or Journal of family practice.nj. or Family practice.nj. or Annals of  
medicine.nj. or British journal of general practice.jn. or Journal of internal medicine.nj. or  
Medical journal of Australia.nj. or Southern medical journal.nj. or Western journal of  
medicine.nj. or "Australian and New Zealand journal of medicine".nj. or Medical care.nj. or  
Health services research.nj. or Inquiry.jn. or Milbank quarterly.nj. or Health affairs.jn. or Health  
care financing review.nj. or Effective clinical practice.jn. or "Evaluation & the health  
professions".nj. or Joint Commission journal on quality improvement.nj. or "Quality & safety in  
health care".nj. or International journal for quality in health care.jn. or Quality in health care.jn.  
or Qualitative health research.nj. or "Report on medical guidelines & outcomes research".nj. or  
American journal of managed care.nj. or American journal of medical quality.jn. or Journal of  
continuing education in the health professions.nj. or Preventive medicine.nj. or American journal  
of preventive medicine.nj. or "Patient education and counseling".nj. or Annals of behavioral  
medicine.jn. or Journal of the American Society of Nephrology.jn. or Clinical journal of the  
American Society of Nephrology : CJASN.nj. or Kidney international.nj. or American journal of  
kidney diseases.jn. or nephrology dialysis transplantation.jn. or seminars in dialysis.nj. or

Advances in chronic kidney disease.nj. or American journal of nephrology.nj. or BMC nephrology.nj. or british journal of renal medicine.nj. or "Clinical and experimental nephrology".nj. or "Current opinion in nephrology and hypertension".nj. or Journal of nephrology.nj. or Journal of renal nutrition.jn. or "kidney and blood pressure research".nj. or "Nature reviews. Nephrology".nj. or Nephrology.jn. or renal failure.nj. or Seminars in nephrology.nj. or "Medical care research and review : MCRR".nj. or "Clinical and investigative medicine. Medecine clinique et experimentale".nj. (723538)

61 (((comprehensive\* or systematic\*) adj3 (bibliographic\* or review\* or literature)) or (meta-analy\* or metaanaly\* or "research synthesis" or ((information or data) adj3 synthesis) or (data adj2 extract\*))) .ti,ab. or (cinahl or (cochrane adj3 trial\*) or embase or medline or psyclit or (psycinfo not "psycinfo database") or pubmed or scopus or "sociological abstracts" or "web of science") .ab. or "cochrane database of systematic reviews" .jn. or ((review adj5 (rationale or evidence)) .ti,ab. and review.pt.) or meta-analysis as topic/ or Meta-Analysis.pt. (162754)

62 randomized controlled trial.pt. (338665)

63 controlled clinical trial.pt. (85051)

64 randomized.ab. (256146)

65 placebo.ab. (140029)

66 drug therapy.fs. (1571915)

67 randomly.ab. (187482)

68 trial.ab. (263953)

69 groups.ab. (1214422)

70 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 (3034550)

71 exp animals/ not humans.sh. (3751732)

72 70 not 71 (2593753)

73 60 or 61 or 72 (3293067)

74 59 and 73 (1463325)

75 exp Renal Insufficiency, Chronic/ (76107)

76 ((renal or kidney) adj2 (insufficiency or insufficiencies or disease\* or failure)) .ti. (61228)

77 (CKD or ESRD).ti. (2647)

78 75 or 76 or 77 (110298)

79 74 and 78 (21388)

80 limit 79 to (comment or editorial or letter) (1531)

81 79 not 80 (19857)

82 limit 81 to ("all infant (birth to 23 months)" or "all child (0 to 18 years)") (3132)

83 limit 82 to "all adult (19 plus years)" (2222)

84 82 not 83 (910)

85 81 not 84 (18947)

86 limit 85 to yr="2003 -Current" (12481)

## **Appendix Figure 2: Framework of quality improvement strategies (adapted with permission from reference #8)**

### Strategies targeted at the healthcare system

#### *Case management*

- Systems that focus on the coordination diagnosis, treatment, or routine management of patients (e.g., arrangement for referrals, follow-up of test results) by a person or multidisciplinary team
- If the study called the intervention “case management,” we classified it as such
- Case management studies were less intensive interventions than team changes (i.e., case managers were not required to speak with primary care or specialist physicians)

#### *Team changes*

To ensure that every study we classified as case management did not also qualify as a team change, we required team changes to satisfy at least two of the following conditions:

- Adding a team member (e.g., routine visits with people other than a physician, such as nurse specialists, pharmacists, and nutritionists)
- Use of multidisciplinary teams (i.e., active participation of professionals from more than one discipline in the routine management of patients)
- Expansion or revision of professional roles (e.g., nurse or pharmacist have a more active role in patient monitoring or adjusting drug regimens)

In general, team changes involved more communication between healthcare providers than case management.

### *Electronic patient registries*

- An electronic medical record system or electronic tracking system for patients with chronic kidney disease
- To qualify, we required the registry to be actively used by study participants and explicitly listed as a key component of the quality improvement initiative

### *Facilitated relay of information to clinicians*

- Clinical information collected from patients and transmitted to clinicians by means other than the conventional method of correspondence
- Patients were usually the facilitator, and we required the information to reach a healthcare provider with the ability to order investigations or prescribe therapy
- Examples include novel methods for patients to record self-care data (e.g., blood pressure), chronic kidney disease passports, and referral systems

This quality improvement intervention often occurred with case management or team changes.

For example, if the intervention involved the expansion of a nurse's role to include routine drug adjustments along with a patient drug passport, we would classify it as team changes (new team member with expanded role) and facilitated relay of clinical information (drug passport as novel self-care tool).

### *Continuous quality improvement*

- Interventions involving any iterative process for assessing quality of care problems, developing solutions to those problems, testing their effects, and reassessing the need for further action (e.g., plan-do-study-act)

### Strategies targeted at healthcare providers

#### *Audit and feedback*

- Summary of the clinical performance delivered by an individual clinician or clinic, which is then transmitted back to the clinician
- We required the transmitted information to include clinical data

#### *Education*

- Interventions designed to promote increased understanding of clinical care or awareness of specific recommendations for a target disorder or population of patients (e.g., conferences, educational materials, educational outreach visits/academic detailing)

#### *Reminders*

- Paper-based or electronic systems intended to prompt a healthcare professional to recall patient-specific information or to complete a specific task
- We required all reminders to be a systematic component of the intervention

### Strategies targeted at patients

#### *Self-management*

- Provision of resources or equipment to promote self-management.
- We included personalized goal-setting or action-planning as self-management

In general, we classified active interventions as self-management and passive interventions as education.

### *Education*

- Interventions designed to promote greater understanding of a target disorder or to teach specific prevention/treatment strategies
- We required all education interventions to be a mandatory component of the quality improvement initiative

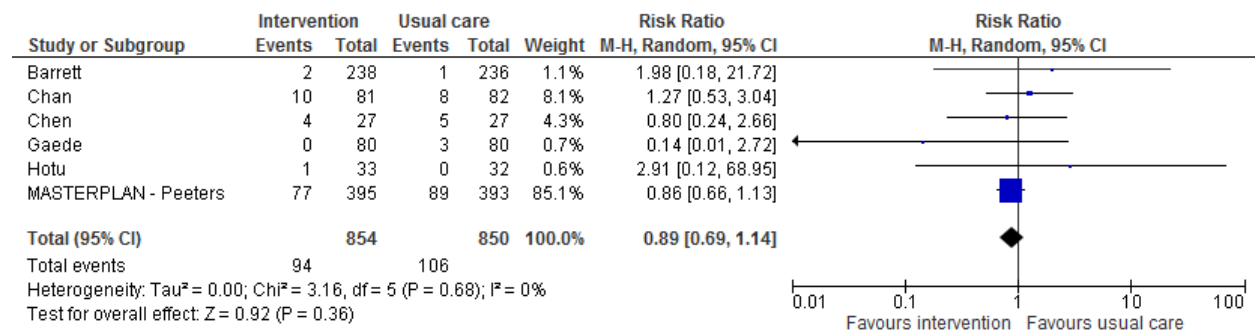
### *Reminders*

- Efforts to remind patients about upcoming appointments or aspects of self-care (e.g., telephone calls)
- When combined with other quality improvement initiatives (e.g., case management), we required the reminders to be explicitly listed as a key component of the intervention



### Appendix Figure 3: Results of post-hoc analysis for the dialysis incidence outcome

The study by Devins *et al.* (reference #28) has been removed from this analysis.



**Appendix Table 1: Pre-specified study outcomes**

<b>Healthcare Component</b>	<b>Process Measure</b>	<b>Surrogate Outcome</b>	<b>Hard Clinical Outcome</b>
Anemia	<ul style="list-style-type: none"> <li>• Hemoglobin measurement</li> <li>• Iron status measurement</li> <li>• Proportion of patients on erythropoietin</li> <li>• Proportion of patients on supplemental iron</li> </ul>	<ul style="list-style-type: none"> <li>• Hemoglobin levels</li> <li>• Proportion of patients with hemoglobin between 9.0-11.5g/dL</li> <li>• Proportion of patients with normal iron indices, as per the KDIGO CKD guidelines</li> </ul>	<ul style="list-style-type: none"> <li>• Blood transfusions</li> </ul>
Glycemic control	<ul style="list-style-type: none"> <li>• HbA1c measurement</li> <li>• Proportion of eligible patients on hypoglycemic drugs</li> <li>• Proportion of eligible patients on insulin</li> </ul>	<ul style="list-style-type: none"> <li>• HbA1c levels</li> <li>• Proportion of patients with target HbA1c</li> </ul>	<ul style="list-style-type: none"> <li>• Hypoglycaemia</li> </ul>
Mineral metabolism	<ul style="list-style-type: none"> <li>• Calcium measurement</li> <li>• Phosphate measurement</li> <li>• PTH measurement</li> <li>• Proportion of patients with elevated phosphate on binders</li> <li>• Proportion of patients with low calcium on calcitriol</li> </ul>	<ul style="list-style-type: none"> <li>• Calcium levels</li> <li>• Proportion of patients with normal calcium values</li> <li>• Phosphate levels</li> <li>• Proportion of patients with normal phosphate values</li> <li>• PTH levels</li> </ul>	<ul style="list-style-type: none"> <li>• Calciphylaxis</li> <li>• Fractures</li> </ul>
Multidisciplinary care and renal replacement planning	<ul style="list-style-type: none"> <li>• Proportion of patients followed in a multidisciplinary clinic</li> <li>• Proportion of patients seeing a dietician</li> <li>• Proportion of patients receiving modality education</li> <li>• Proportion of patients assessed for home dialysis</li> <li>• Proportion of patients with chosen modality recorded in chart</li> <li>• Proportion of patients with dialysis access referral or procedure (e.g., vascular surgeon referral, vascular mapping, buried peritoneal dialysis catheter)</li> </ul>	<ul style="list-style-type: none"> <li>• Proportion of patients with fistulas placed</li> <li>• Proportion of patients with living kidney donor identified</li> </ul>	<ul style="list-style-type: none"> <li>• Crash starts on dialysis</li> <li>• Pre-emptive kidney transplantation</li> <li>• Living kidney transplantation</li> <li>• Use of peritoneal dialysis</li> <li>• Use of home hemodialysis</li> </ul>

Healthcare Component	Process Measure	Surrogate Outcome	Hard Clinical Outcome
Quality of life			<ul style="list-style-type: none"> <li>• Quality of life</li> </ul>
Renal function	<ul style="list-style-type: none"> <li>• Proportion of patients with recognized CKD</li> <li>• Proportion of eligible patients with urine microalbuminuria testing</li> <li>• Proportion of eligible patients on ACE-inhibitor/ARB therapy</li> <li>• Proportion of eligible patients on oral bicarbonate therapy</li> </ul>	<ul style="list-style-type: none"> <li>• Proteinuria levels</li> <li>• Estimated glomerular filtration rate</li> </ul>	<ul style="list-style-type: none"> <li>• Dialysis</li> </ul>
Smoking cessation	<ul style="list-style-type: none"> <li>• Proportion of patients with smoking status recorded</li> <li>• Proportion of patients with smoking cessation counseling</li> <li>• Proportion of patients with nicotine replacement</li> </ul>	<ul style="list-style-type: none"> <li>• Proportion of patients successfully quitting smoking over a specific period</li> </ul>	<ul style="list-style-type: none"> <li>• Long-term rate of smoking cessation</li> </ul>
Healthcare system	<ul style="list-style-type: none"> <li>• Proportion of eligible CKD patients who see a nephrologist</li> </ul>		<ul style="list-style-type: none"> <li>• Costs</li> <li>• Hospital utilization (e.g., readmissions)</li> </ul>
Vascular risk factor control	<ul style="list-style-type: none"> <li>• Proportion of patients on aspirin</li> <li>• Proportion of patients with lipids monitored</li> <li>• Proportion of patients on statin therapy</li> <li>• Proportion of patients with blood pressure monitored</li> <li>• Proportion of patients on antihypertensive therapy</li> <li>• Proportion of patients on ACE-inhibitor/ARB therapy</li> <li>• Proportion of patients adherent to a low sodium diet</li> </ul>	<ul style="list-style-type: none"> <li>• Lipid levels</li> <li>• Systolic blood pressure</li> <li>• Diastolic blood pressure</li> <li>• Proportion of patients with blood pressure at target levels</li> <li>• Weight</li> <li>• Body mass index</li> </ul>	<ul style="list-style-type: none"> <li>• Myocardial infarction</li> <li>• Stroke</li> <li>• Heart failure</li> <li>• Coronary revascularization procedure</li> <li>• Vascular surgery</li> </ul>

Abbreviations: ACE=angiotensin converting enzyme; ARB=angiotensin receptor blocker; CKD=chronic kidney disease; HbA1c=glycated hemoglobin; KDIGO=kidney disease improving global outcomes; PTH=parathyroid hormone