# ISPD peritonitis guidelines

## Key aspects of the 2022/23 release

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# Declarations

- None

# Agenda

- New (-ish) recommendations
- Things that should be prioritized until the next update

# Guidelines

- Not policies

- Information intended to advise people on how something should be done or what something should be; something that can be used to help **you plan your actions** or to form an opinion about something

# Guidelines

- “Individual clinical situations and variability in patient populations may necessitate modification of the ISPD recommendations”

PeritonealDialysisBulletin, Volume 7. Number2, April-June 1987 57

# REVIEWS AND ORIGINAL ARTICLES

## CAPD RELATED PERITONITIS MANAGEMENT AND ANTIBIOTIC THERAPY RECOMMENDATIONS Travenol Peritonitis Management Advisory Committee

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CAPD Related Peritonitis Management and Antibiotic Therapy Recommendations: Travenol Peritonitis Management Advisory Committee 1987

TABLE I: *Antibiotic dosing guidelines for the treatment of CAPD peritonitis*

| | HALF-LIFE (H) | | | DOSE* | | | |
|---|---|---|---|---|---|---|---|
| | | | | INITIAL | | MAINTENANCE | |
| | NORMAL | ESRD | CAPD | MG/KG | MG/2L BAG | MG/L | MG/EACH 2L/BAG |
| AMINOGLYCOSIDES | | | | | | | |
| Amikacin | 1.6 | 39 | ND | 5.0-7.5 | 350-500 | 6-7.5 | 12-15 |
| Gentamicin | 2.2 | 53 | 32 | 1.5-1.7 | 120 | 4-6 | 8-12 |
| Netilmicin | 2.1 | 42 | ND | 1.5-2.0 | 140 | 4-6 | 8-12 |
| Tobramycin | 2.5 | 58 | 36 | 1.5-1.7 | 120 | 4-6 | 9-12 |
| CEPHALOSPORINS | | | | | | | |
| Cefamandole | 1.0 | 10 | 8.0 | — | 1000 | ND | ND |
| Cefazolin | 2.2 | 28 | 27 | — | 500-1000 | 125-250 | 250-500 |
| Cefoperazone | 1.8 | 2.3 | 2.2 | — | 2000 | 500 | 1000 |
| Cefotaxime | 0.9 | 2.5 | 2.4 | — | 2000 | 250 | 500 |
| Cefoxitin | 0.8 | 20 | 15 | — | 1000 | 100 | 200 |
| Ceftazidime | 1.8 | 26 | 16 | — | 1000 | 125 | 250 |
| Ceftizoxime | 1.6 | 28 | 11 | — | 1000 | 125 | 250 |
| Ceftriaxone | 8.0 | 15 | 13 | — | 1000 | ND | ND |
| Cefuroxime | 1.3 | 18 | 15 | — | 1500 | 250 | 500 |
| Cephalothin | 0.2 | 3.7 | ND | — | 2000 | 250 | 500 |
| Moxalactam | 2.2 | 20 | 16 | — | 1000 | ND | ND |
| Cephradine | 0.9 | 12 | ND | — | 500 | 125-250 | 250-500 |
| | | | | | 1000 PO | NA | NA |
| Cephalexin | 0.8 | 19 | 9 | — | 1000 PO | NA | NA |
| PENICILLINS | | | | | | | |
| Ampicillin | 1.3 | 15 | ND | — | 500 | 50 | 100 |
| Azlocillin | 0.9 | 5.1 | ND | — | 500 | 250 | 500 |
| Mezlocillin | 1.0 | 4.3 | ND | — | 3000 IV | 3000/12 h IV | ND |
| Piperacillin | 1.2 | 3.9 | ND | — | 4000 IV | 4000/12 h IV | ND |
| Ticarcillin | 1.2 | 15 | ND | — | 2000 IV | 2000/12 h IV | ND |
| VANCOMYCIN AND OTHERS | | | | | | | |
| Vancomycin | 6.9 | 161 | 83 | — | 1000 | 15 | 30 |
| Aztreonam | 2.0 | 7.0 | 7.1 | — | 1000 | 250 | 500 |
| Ciprofloxacin | 4.0 | 8.0 | 13 | — | 750 PO | ND | ND |
| Clindamycin | 2.8 | 2.8 | ND | — | 300 | 150 | 300 |
| Erythromycin | 2.1 | 4.0 | ND | — | 300 | 75 | 150 |
| Metronidazole | 7.9 | 7.7 | 11 | — | 500 PO/IV | ND | ND |
| Rifampin | 4 | 8 | ND | — | 600 PO | NA | NA |
| Sulfamethoxazole | 10 | 13 | 14 | — | 1600 PO | 100-200 | 200-400 |
| Trimethoprim | 14 | 33 | 34 | — | 320 PO | 20-40 | 40-80 |
| ANTIFUNGAL | | | | | | | |
| Amphotericin | 360 | 360 | ND | — | 0.5 | 0.5 | 1 |
| Flucytosine | 4.2 | 115 | ND | — | 3000 PO | NA | NA |
| | | | | | 200 | 50-100 | 100-200 |
| Ketoconazole | 2 | 1.8 | 2.4 | — | 400 PO | NA | NA |
| Miconazole | 24 | 25 | ND | — | 100 | 50 | 100 |

* All doses are calculated for a 70 kg person who is using standard 2 L bags. The route of administration is intraperitoneal unless otherwise specified. These data should only be utilized as initial "guidelines." Individualized dosing is recommended when possible.

The Pharmacokinetic data and dosing recommendations presented here are based on published literature reviewed through January 1987 and personal experience. Those dosage recommendations which differ from product labelling are based on more recent experience.

There is no evidence that mixing different antibiotics in dialysis fluid (except for aminoglycosides and penicillins) is deleterious for the drugs or patients. Do not use the same syringe to mix antibiotics.

ESRD = creatinine clearance @ 10 mg/min, patient not on dialysis
NA = not applicable
ND = no data
IV = intravenous
PO = oral

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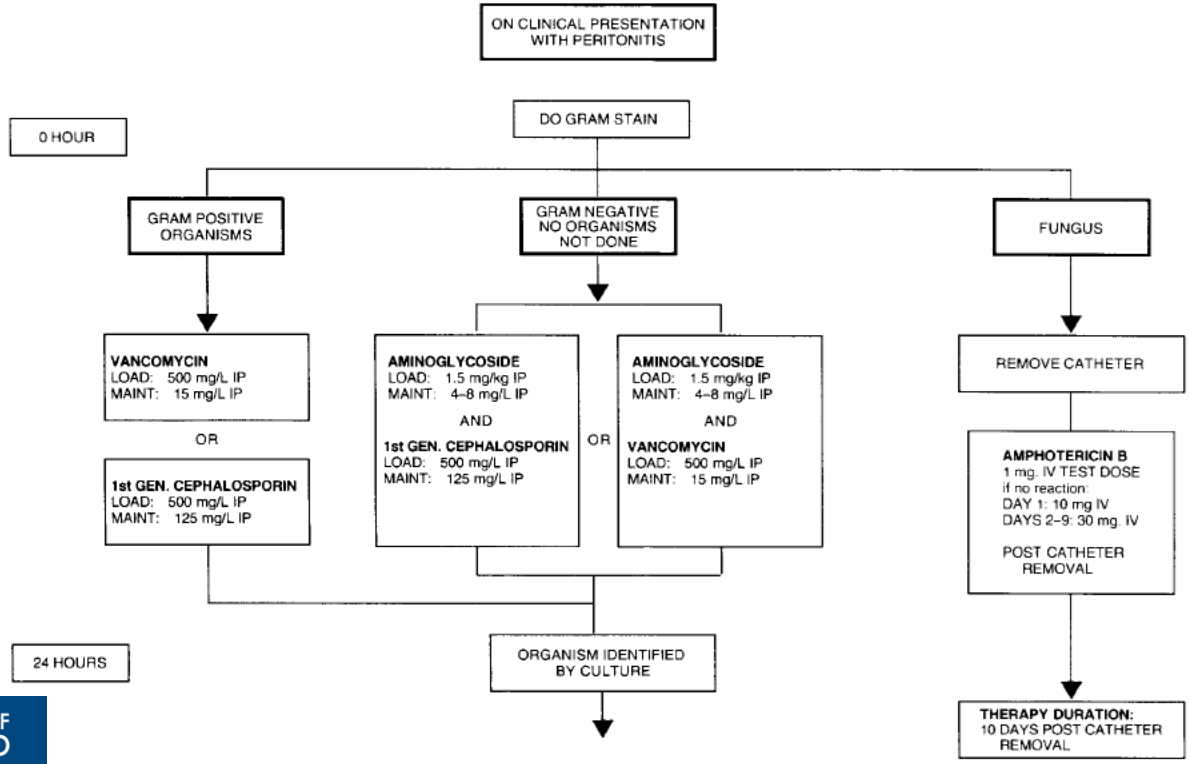
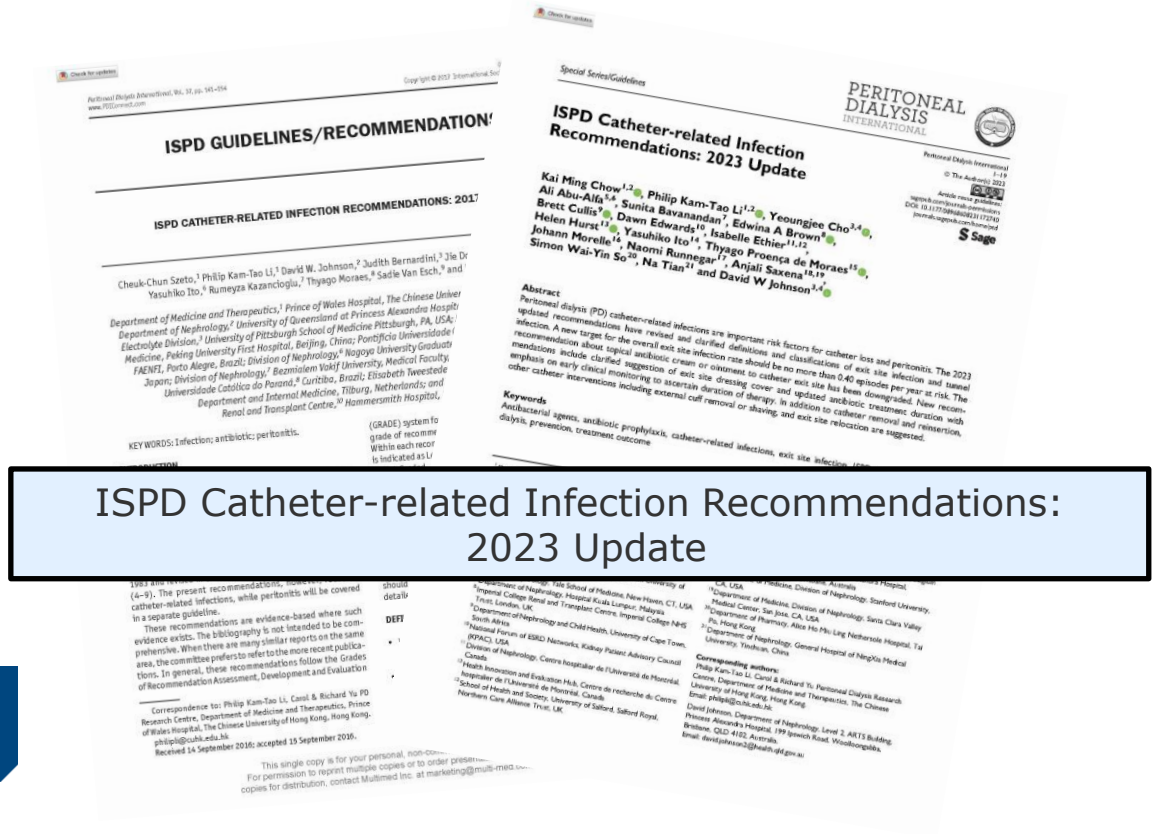

ON CLINICAL PRESENTATION WITH PERITONITIS
DO GRAM STAIN
0 HOUR
GRAM POSITIVE ORGANISMS
GRAM NEGATIVE NO ORGANISMS NOT DONE
FUNGUS
VANCOMYCIN
LOAD: 500 mg/L IP
MAINT: 15 mg/L IP
OR
1st GEN. CEPHALOSPORIN
LOAD: 500 mg/L IP
MAINT: 125 mg/L IP
AMINOGLYCOSIDE
LOAD: 1.5 mg/kg IP
MAINT: 4–8 mg/L IP
AND
1st GEN. CEPHALOSPORIN
LOAD: 500 mg/L IP
MAINT: 125 mg/L IP
OR
AMINOGLYCOSIDE
LOAD: 1.5 mg/kg IP
MAINT: 4–8 mg/L IP
AND
VANCOMYCIN
LOAD: 500 mg/L IP
MAINT: 15 mg/L IP
REMOVE CATHETER
AMPHOTERICIN B
1 mg. IV TEST DOSE
if no reaction:
DAY 1: 10 mg IV
DAYS 2–9: 30 mg. IV
POST CATHETER REMOVAL
24 HOURS
ORGANISM IDENTIFIED BY CULTURE
THERAPY DURATION:
10 DAYS POST CATHETER REMOVAL

# ISPD infection-relevant guidelines

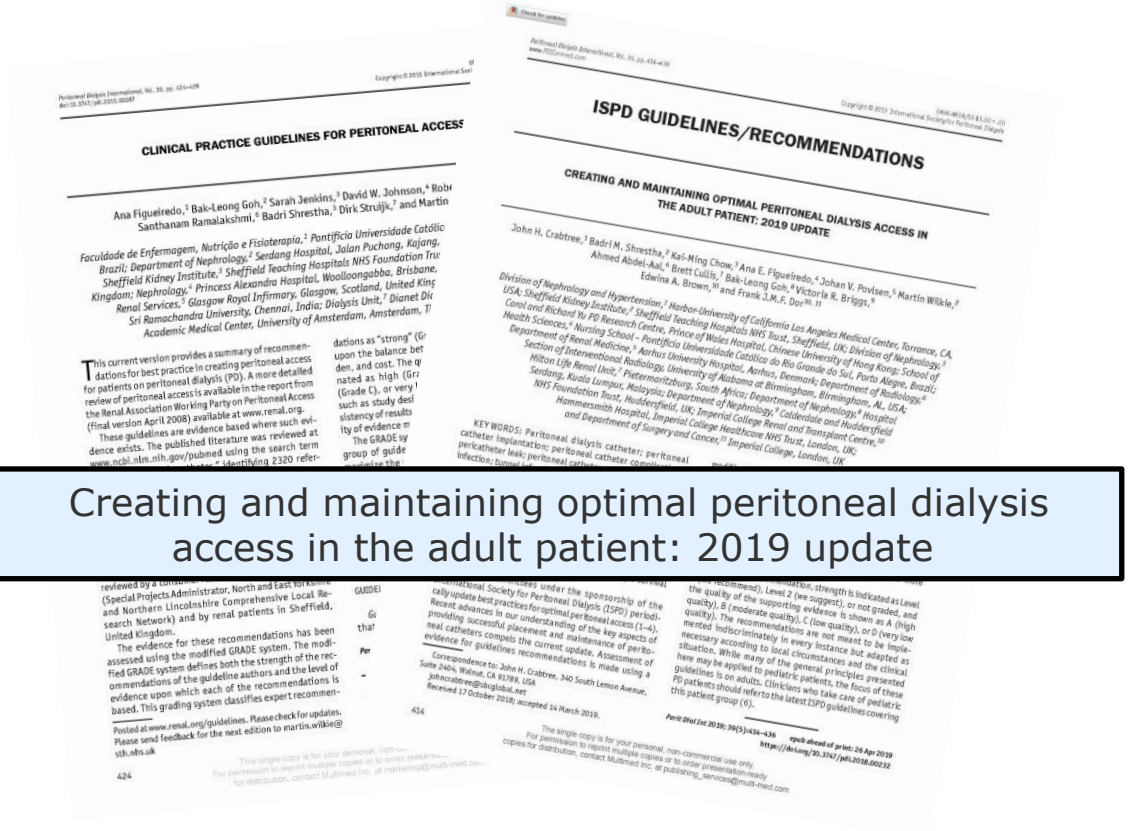
| Meta-data | 1987 | 1989 | 1993 | 1996 | 2000 | 2005 | 2010 | 2010 Access | 2016 | 2016 Training | 2017 ESI / Tunnel | 2019 Access | 2022 | 2023 ESI / Tunnel |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of pages | | | | | 15 | 24 | 30 | 5 | 27 | 13 | 13 | 22 | 43 | 19 |
| Industry sonspored | | | | | | | | | | | | | | |
| Evidence grading | | | | | | | | | | | | | | |

# ISPD infection-relevant guidelines




ISPD Catheter-related Infection Recommendations: 2023 Update

# ISPD infection-relevant guidelines



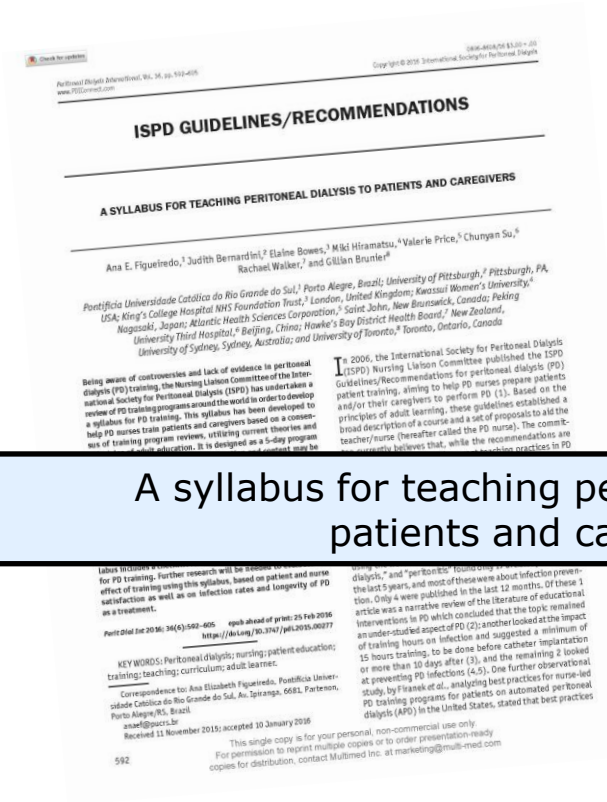
CLINICAL PRACTICE GUIDELINES FOR PERITONEAL ACCESS

ISPD GUIDELINES/RECOMMENDATIONS

CREATING AND MAINTAINING OPTIMAL PERITONEAL DIALYSIS ACCESS IN THE ADULT PATIENT: 2019 UPDATE

Creating and maintaining optimal peritoneal dialysis access in the adult patient: 2019 update

# ISPD infection-relevant guidelines



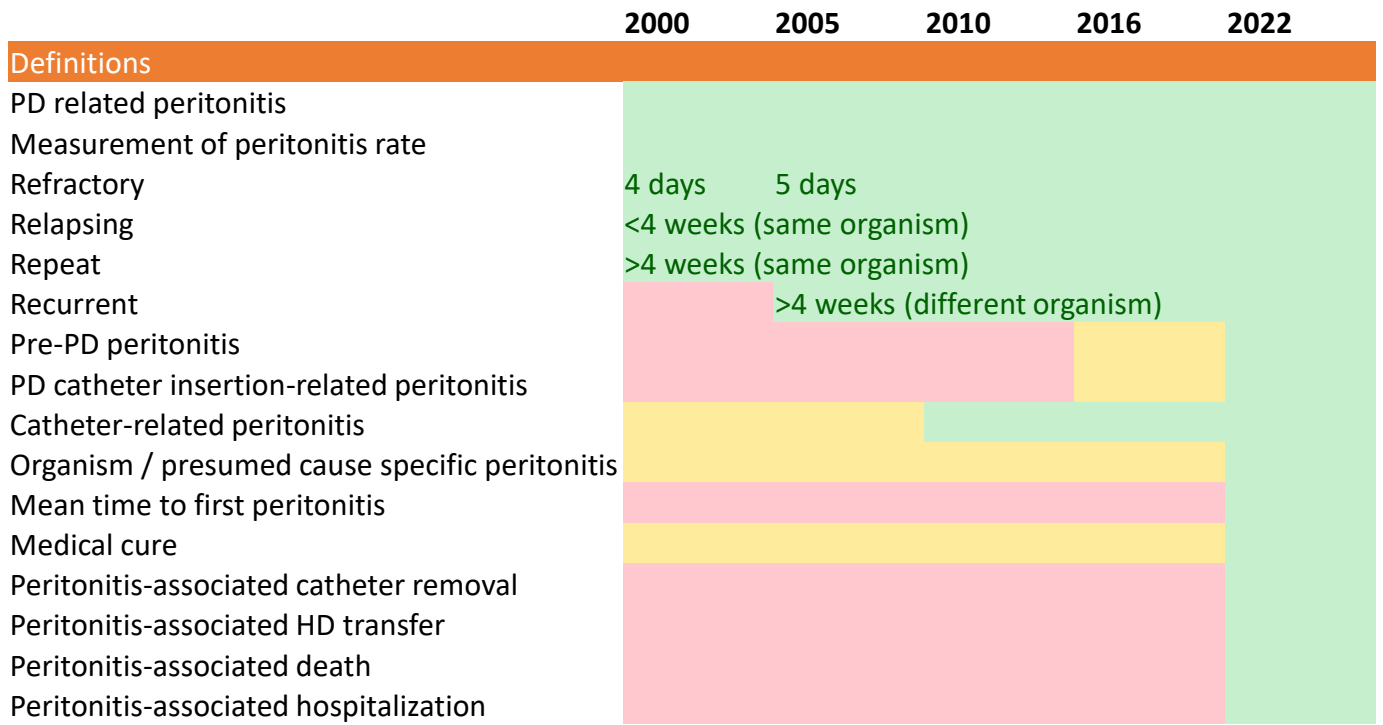
ISPD GUIDELINES/RECOMMENDATIONS

A SYLLABUS FOR TEACHING PERITONEAL DIALYSIS TO PATIENTS AND CAREGIVERS

A syllabus for teaching peritoneal dialysis to patients and caregivers

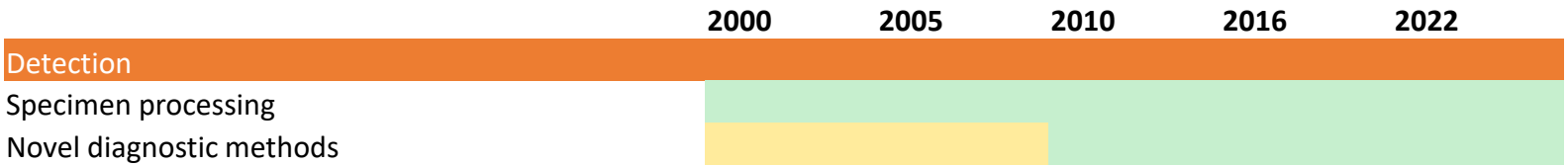
# 2022 Update Guideline – major elements

- Definitions
- Detection
- Monitoring
- Treatment
- Prevention


2000
2005
2010
2016
2022
Definitions
PD related peritonitis
Measurement of peritonitis rate
Refractory
4 days
5 days
Relapsing
<4 weeks (same organism)
Repeat
>4 weeks (same organism)
Recurrent
>4 weeks (different organism)
Pre-PD peritonitis
PD catheter insertion-related peritonitis
Catheter-related peritonitis
Organism / presumed cause specific peritonitis
Mean time to first peritonitis
Medical cure
Peritonitis-associated catheter removal
Peritonitis-associated HD transfer
Peritonitis-associated death
Peritonitis-associated hospitalization

# Guideline – major elements

- Definitions
- Detection
- Monitoring
- Treatment
- Prevention


2000
2005
2010
2016
2022
Detection
Specimen processing
Novel diagnostic methods

# Guideline – major elements

- Definitions
- Detection
- Monitoring
- Treatment
- Prevention

| | 2000 | 2005 | 2010 | 2016 | 2022 |
|---|---|---|---|---|---|
| Monitoring | | | | | |
| Monitoring of PD peritonitis rate | | 0.67 | 0.67 | 0.5 | 0.4 |
| % of patients free of peritonitis per year | | | | | 80% |
| Organism / presumed cause specific peritonitis rate | | | | | |
| Time to first peritonitis | | | | | |
| Monitoring response to peritonitis treatment | | | | | |
| PD catheter insertion-related peritonitis | | | | | <5% |
| Culture negative peritonitis | | 20% | 20% | 15% | 15% |
| Root-cause review of each peritonitis | | | | | |
| Programmatic CQI | | | | | |

# Guideline – major elements

- Definitions
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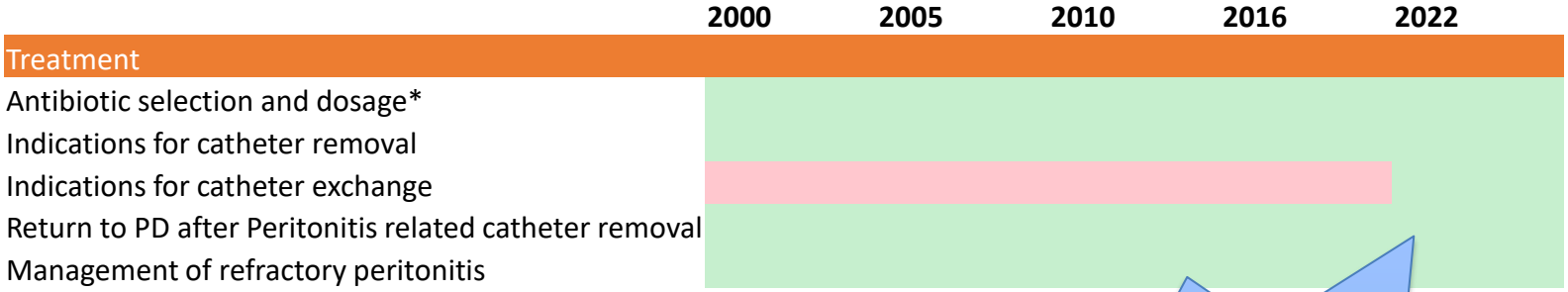
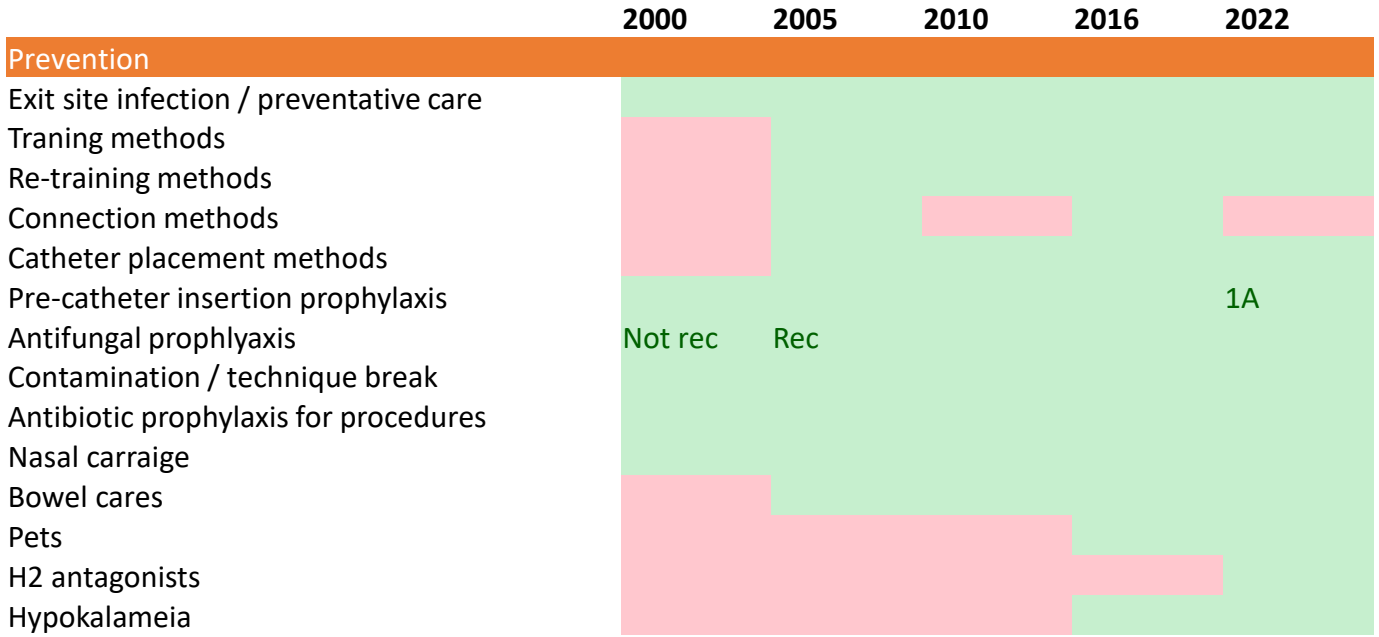
- Treatment
- Prevention




**Callout to the ISPD – where is the app?**

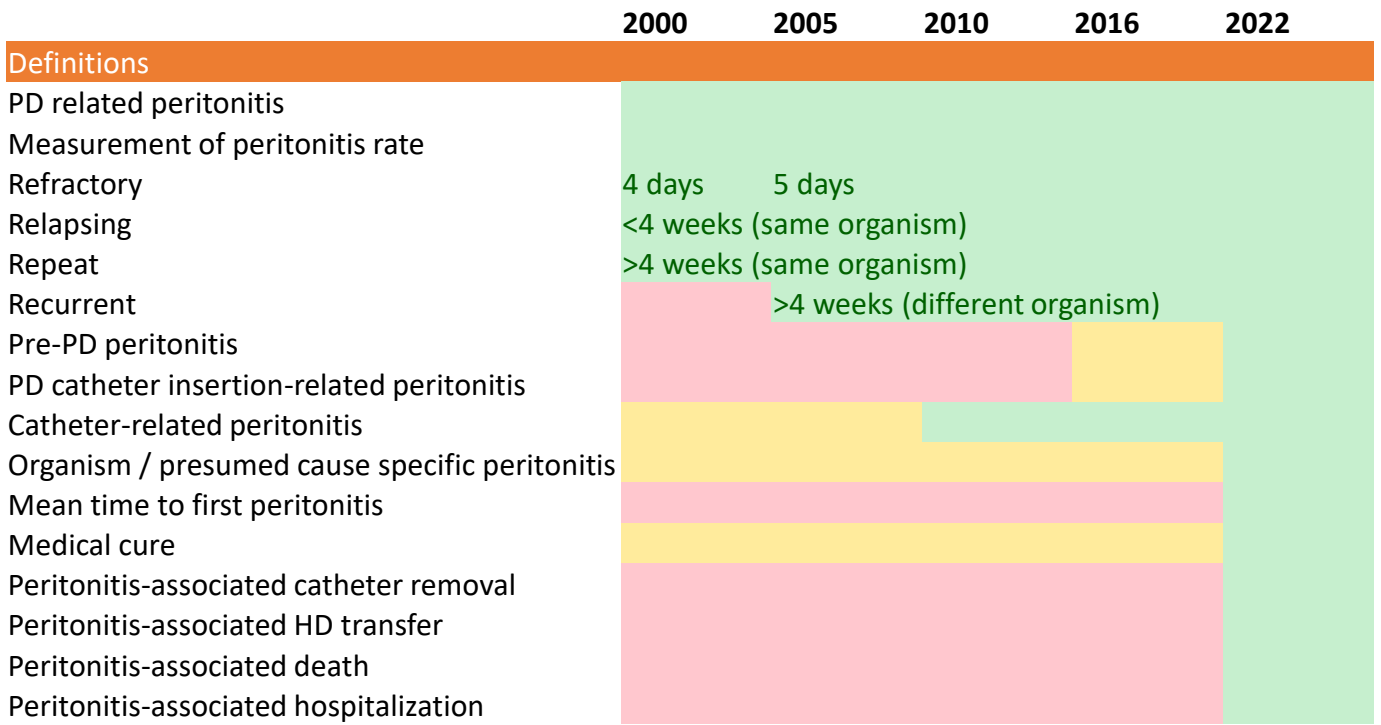
# Guideline – major elements

- Definitions
- Detection
- Monitoring
- Treatment
- Prevention


2000
2005
2010
2016
2022
Prevention
Exit site infection / preventative care
Traning methods
Re-training methods
Connection methods
Catheter placement methods
Pre-catheter insertion prophylaxis
1A
Antifungal prophlyaxis
Not rec
Rec
Contamination / technique break
Antibiotic prophylaxis for procedures
Nasal carraige
Bowel cares
Pets
H2 antagonists
Hypokalameia

# Guideline – major elements

- Definitions
- Detection
- Monitoring
- Treatment
- Prevention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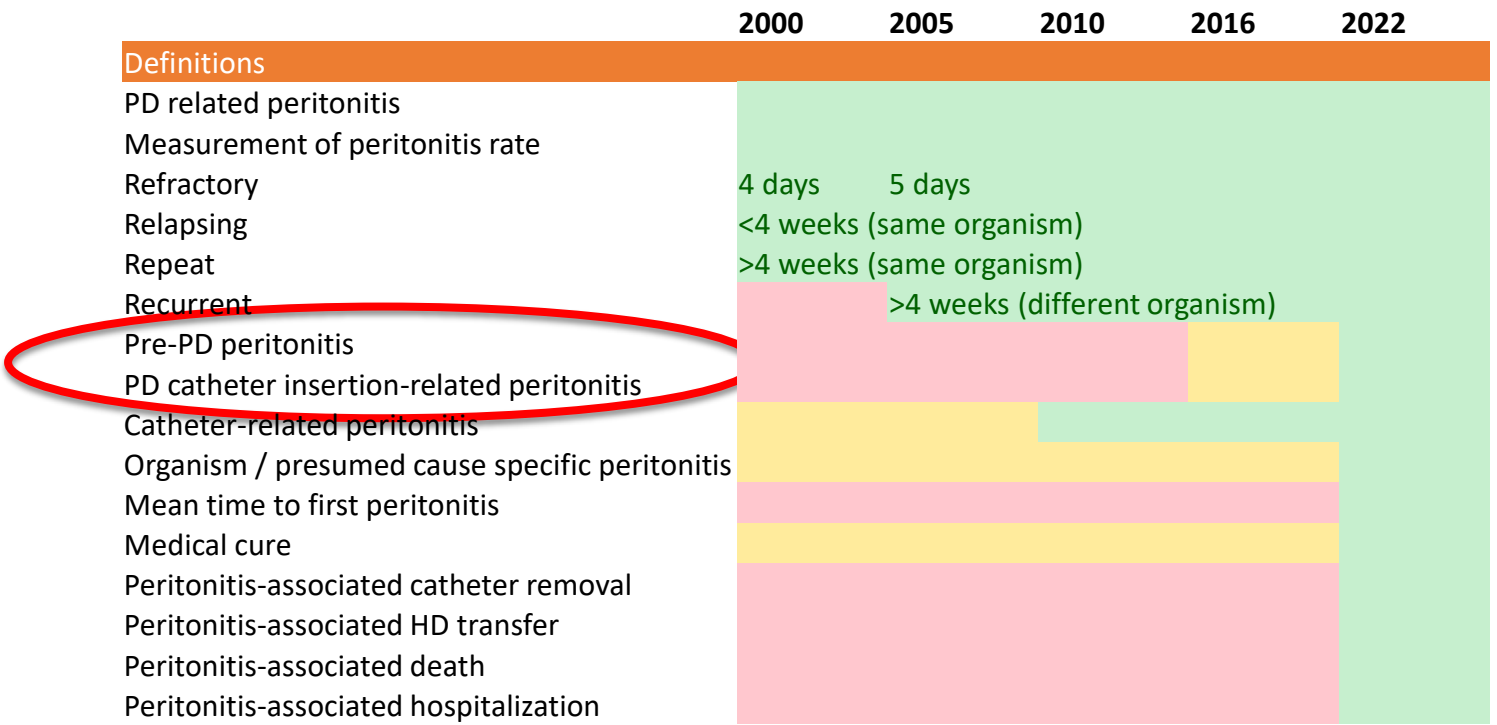
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Peritonitis-associated death
Peritonitis-associated hospitalization

# Pre-PD peritonitis……

- **Definition:** after PD catheter insertion but prior to commencement of PD

- <1% of patients having PD catheter insertion

Ma *et al.*. Peritonitis before Peritoneal Dialysis Training: Analysis of Causative Organisms, Clinical Outcomes, Risk Factors, and Long-Term Consequences. Clin J Am Soc Nephrol. 2016 Jul 7;11(7):1219-1226. https://doi.org/10.2215%2FCJN.00830116

Balzer *et al*. Are ISPD Guidelines on Peritonitis Diagnosis Too Narrow? A 15-Year Retrospective Single-Center Cohort Study on PD-Associated Peritonitis Accounting for Untrained Patients. Perit Dial Int. 2019 May-Jun;39(3):220-228. https://doi.org/10.3747/pdi.2018.00179

# Catheter insertion-related peritonitis

- **Definition:** <30 days after catheter insertion

- Causal factors include
  - Sterility / prophylaxis of the original procedure
  - Flushing / dressings / showering techniques

- **ISPD Standard:** <5% of all catheter insertions

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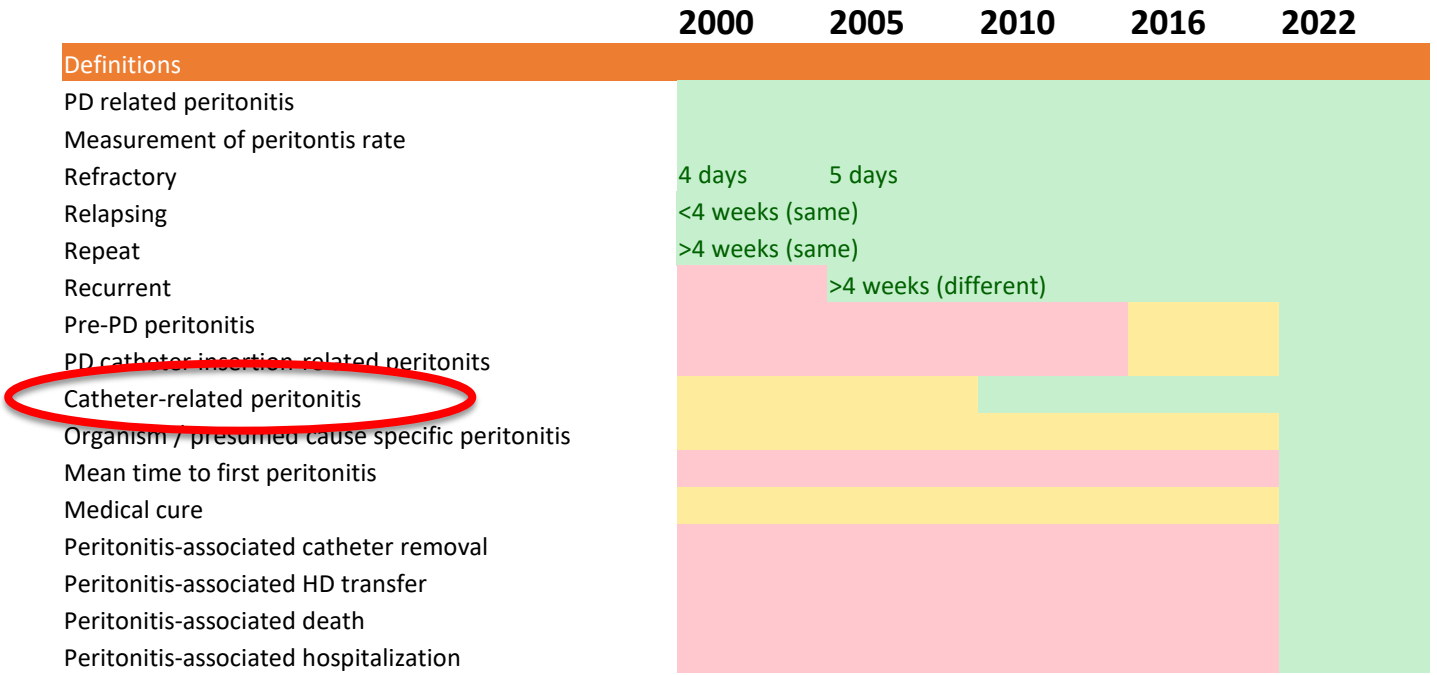
Crabtree *et al*. Creating and Maintaining Optimal Peritoneal Dialysis Access in the Adult Patient: 2019 Update. Perit Dial Int. 2019 Sep-Oct;39(5):414-436. https://doi.org/10.3747/pdi.2018.00232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Peritonitis-associated death
Peritonitis-associated hospitalization
4 days
5 days
<4 weeks (same)
>4 weeks (same)
>4 weeks (different)

# Catheter-related peritonitis

- **Definition:** within 3 months of an ESI or tunnel infection with the same organism (can be presumptive if culture-negative due to antibiotic use)

# Catheter-related peritonitis

| | HR of subsequent peritonitis after ESI |
|---|---|
| Peritonitis with **any** organism | 1.59 (1.22-2.07) |
| Peritonitis with **same** class of organism | 1.55 (1.19-2.02) |

Lloyd *et al*. The risk of peritonitis after an exit site infection: a time-matched, case-control study. Nephrol Dial Transplant. 2013 Jul;28(7):1915-21 https://doi.org/10.1093/ndt/gft002

# Catheter-related peritonitis

| ESI | HR of peritonitis with **same organism or class** | **% of peritonitis** with same organism or class |
|---|---|---|
| Gram +ve | 1.75 (1.26-2.43) | 62.5% |
| Gram -ve | 2.21 (0.73-6.64) | 61.9% |
| *S. aureus* | 5.81 (1.32-25.61) | 86.9% |
| CNS | 2.21 (1.06-4.61) | 63.9% |

Lloyd *et al*. The risk of peritonitis after an exit site infection: a time-matched, case-control study. Nephrol Dial Transplant. 2013 Jul;28(7):1915-21 https://doi.org/10.1093/ndt/gft002

# Catheter-related peritonitis

- ESIs cause peritonitis
  - The peritonitis is mostly the **same** (migration, translocation) organism
  - Sometimes it is a **different** organism (host factors)
  - ***S. aureus* ESI** -> *S. aureus* peritonitis

Lloyd *et al*. The risk of peritonitis after an exit site infection: a time-matched, case-control study. Nephrol Dial Transplant. 2013 Jul;28(7):1915-21 https://doi.org/10.1093/ndt/gft002

Bernardini et al. Analysis of continuous ambulatory peritoneal dialysis-related Pseudomonas aeruginosa infections. Am J Med 1987; 83: 829–832 https://doi.org/10.1016/0002-9343(87)90638-3

# Catheter-related peritonitis

| Time after ESI (months) | OR of peritonitis with **same organism or class** | | | |
|---|---|---|---|---|
| | All | Gm +ve | Gm -ve | *S. Aureus* |
| 3 | 1.36 (0.95–1.95) | 2.27 (1.19–4.31) | 2.50 (0.46–13.71) | 6.00 (0.67–53.98) |
| 6 | 1.43 (1.07–1.94) | 1.88 (1.19–2.97) | 4.00 (0.78–20.44) | 13.00 (1.58–107.03) |
| 9 | 1.63 (1.24–2.15) | 1.91 (1.29–2.83) | 3.25 (0.96–11.00) | 18.00 (2.22–146.15) |

Lloyd *et al*. The risk of peritonitis after an exit site infection: a time-matched, case-control study. Nephrol Dial Transplant. 2013 Jul;28(7):1915-21 https://doi.org/10.1093/ndt/gft002

# Catheter-related peritonitis

- ESIs cause peritonitis
  - The peritonitis is mostly the same (migration, translocation) organism
  - Sometimes it is a different organism (host factors)
  - S. aureus ESI -> S. aureus peritonitis
  - Risk continues **beyond 3 months**


Lloyd *et al*. The risk of peritonitis after an exit site infection: a time-matched, case-control study. Nephrol Dial Transplant. 2013 Jul;28(7):1915-21 https://doi.org/10.1093/ndt/gft002

Bernardini et al. Analysis of continuous ambulatory peritoneal dialysis-related Pseudomonas aeruginosa infections. Am J Med 1987; 83: 829–832 https://doi.org/10.1016/0002-9343(87)90638-3

van Diepen *et al*. The association between exit site infection and subsequent peritonitis among peritoneal dialysis patients. Clin J Am Soc Nephrol. 2012 Aug;7(8):1266-71 https://doi.org/10.2215/cjn.00980112

# Catheter-related peritonitis

- ESIs cause peritonitis
  - The peritonitis is mostly the same (migration, translocation) organism
  - Sometimes it is a different organism (host factors)
  - S. aureus ESI -> S. aureus peritonitis
  - Risk continues beyond 3 months
  - Note: these are risks that occur **despite antibiotic therapy**


Lloyd *et al*. The risk of peritonitis after an exit site infection: a time-matched, case-control study. Nephrol Dial Transplant. 2013 Jul;28(7):1915-21 https://doi.org/10.1093/ndt/gft002

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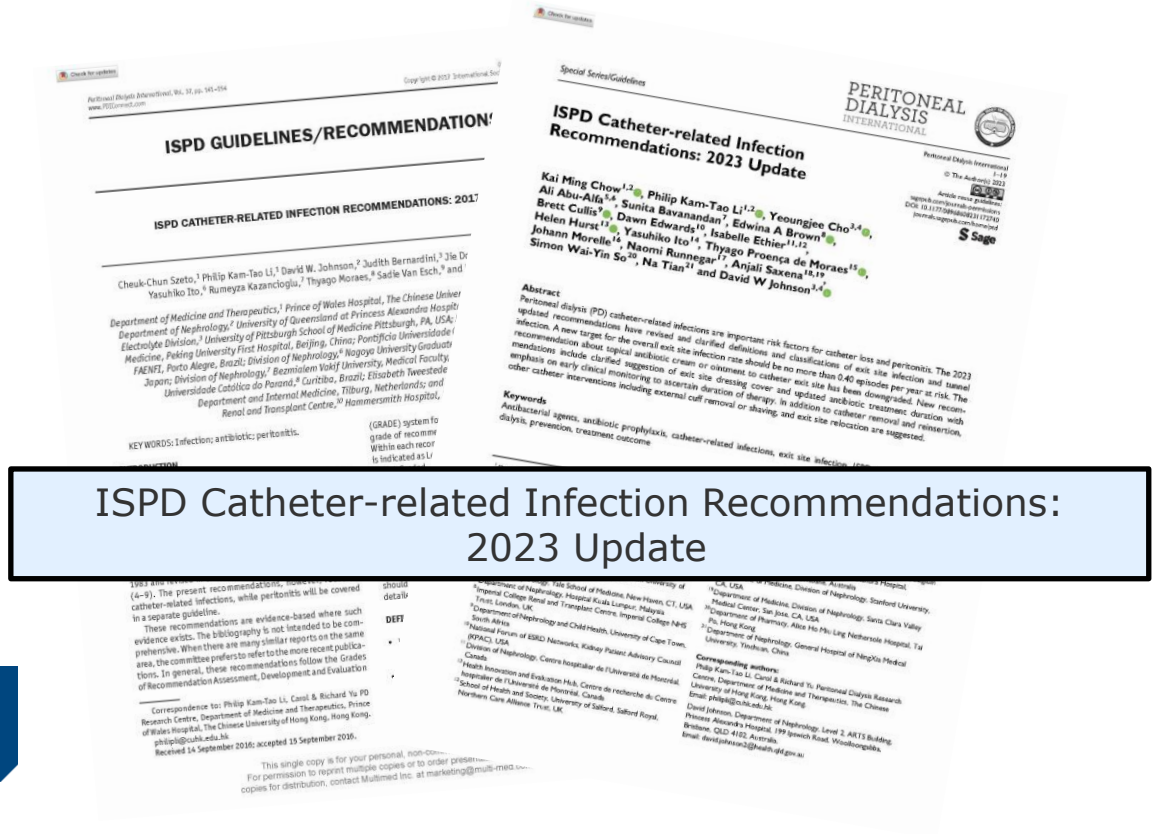
# ISPD infection-relevant guidelines




ISPD Catheter-related Infection Recommendations: 2023 Update

# Catheter-related peritonitis

- Interventions
  - Early recognition and optimal treatment
  - Elimination of *S. aureus* nasal carriage
  - Environment checks
  - Preventative care to exit site
  - Technique check and retraining around exit site care

Chow *et al.* ISPD Catheter-related Infection Recommendations: 2023 Update. Perit Dial Int. 2023 May;43(3):201-219 https://doi.org/10.1177/08968608231172740

Dryden *et al*. Active intervention dramatically reduces CAPD-associated infection. Adv Perit Dial. 1991;7:125-8.

# Catheter-related peritonitis

- **Definition:** within 3 months of an ESI or tunnel infection with the same organism (can be presumptive if culture-negative due to antibiotic use)
- **ISPD recommendation:** should be reported annually (with ESI)
- **ISPD Standard:** ESI < 0.40 episodes per patient-year

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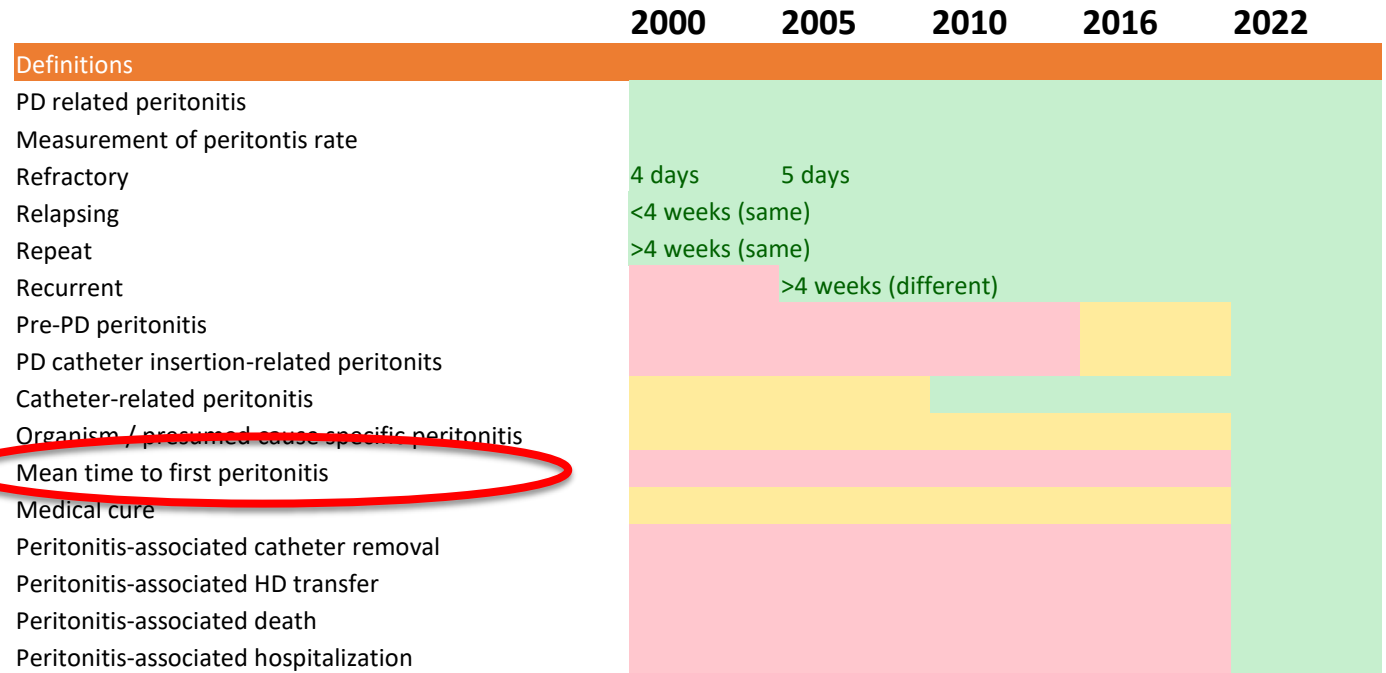
| | 2000 | 2005 | 2010 | 2016 | 2022 |
|---|---|---|---|---|---|
| **Definitions** | | | | | |
| PD related peritonitis | | | | | |
| Measurement of peritontis rate | | | | | |
| Refractory | 4 days | 5 days | | | |
| Relapsing | <4 weeks (same) | | | | |
| Repeat | >4 weeks (same) | | | | |
| Recurrent | | >4 weeks (different) | | | |
| Pre-PD peritonitis | | | | | |
| PD catheter insertion-related peritonits | | | | | |
| Catheter-related peritonitis | | | | | |
| Organism / presumed cause specific peritonitis | | | | | |
| Mean time to first peritonitis | | | | | |
| Medical cure | | | | | |
| Peritonitis-associated catheter removal | | | | | |
| Peritonitis-associated HD transfer | | | | | |
| Peritonitis-associated death | | | | | |
| Peritonitis-associated hospitalization | | | | | |

# Enteric peritonitis

- **Definition:** peritonitis arising from an intestinal source involving processes such as inflammation, perforation or ischemia of intraabdominal organs
  - organisms either enteric in origin or arising from the oral cavity, such as Streptococcus

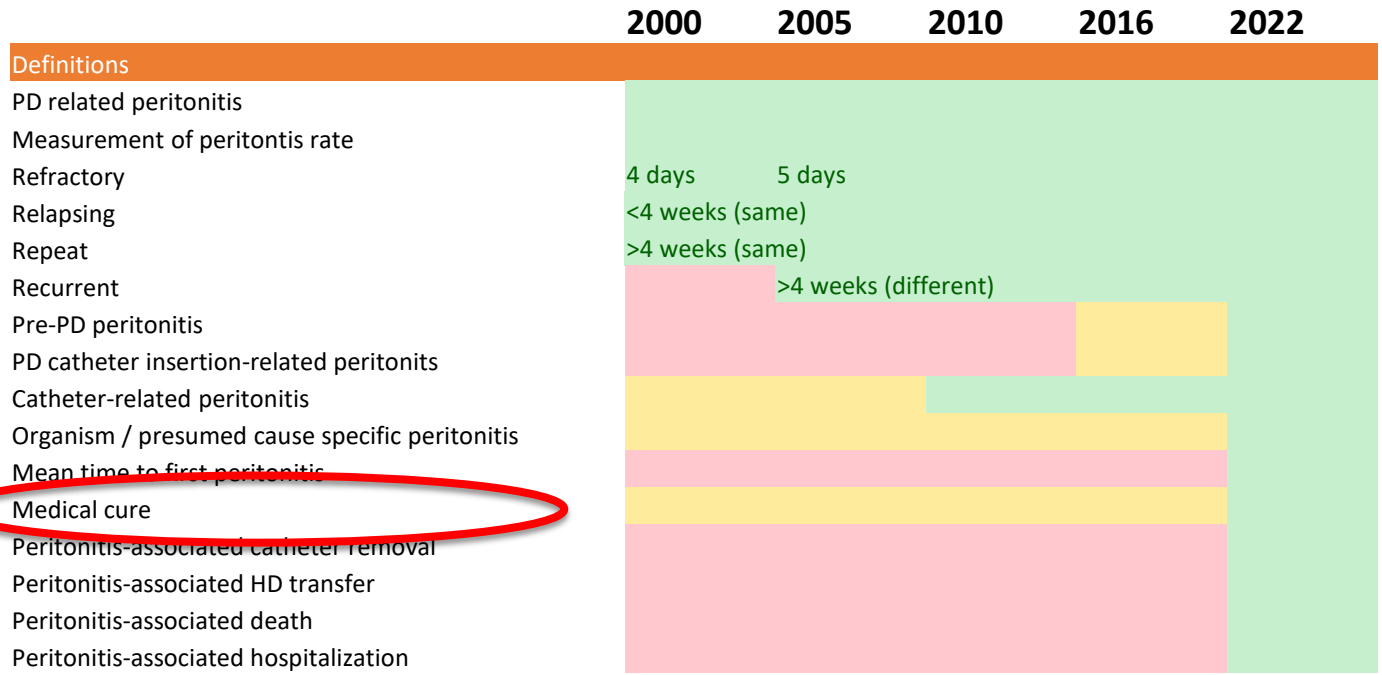

2000
2005
2010
2016
2022
Definitions
PD related peritonitis
Measurement of peritontis rate
Refractory
Relapsing
Repeat
Recurrent
Pre-PD peritonitis
PD catheter insertion-related peritonits
Catheter-related peritonitis
Organism / presumed cause specific peritonitis
Mean time to first peritonitis
Medical cure
Peritonitis-associated catheter removal
Peritonitis-associated HD transfer
Peritonitis-associated death
Peritonitis-associated hospitalization
4 days
5 days
<4 weeks (same)
>4 weeks (same)
>4 weeks (different)

# Mean time to first peritonitis

- Time to first peritonitis = from the start of PD

- Patients who developed an early infections have significantly higher rates of overall infection later on

Crabtree *et al*. Dialysis catheter infection related peritonitis: incidence and time dependent risk. ASAIO J. 1999 Nov-Dec;45(6):574-80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# Medical cure

- **Definition:** resolution of peritonitis without
  - death
  - relapse / recurrent (*sic – should be repeat*) peritonitis
  - catheter removal
  - transfer to HD for ≥ 30 days

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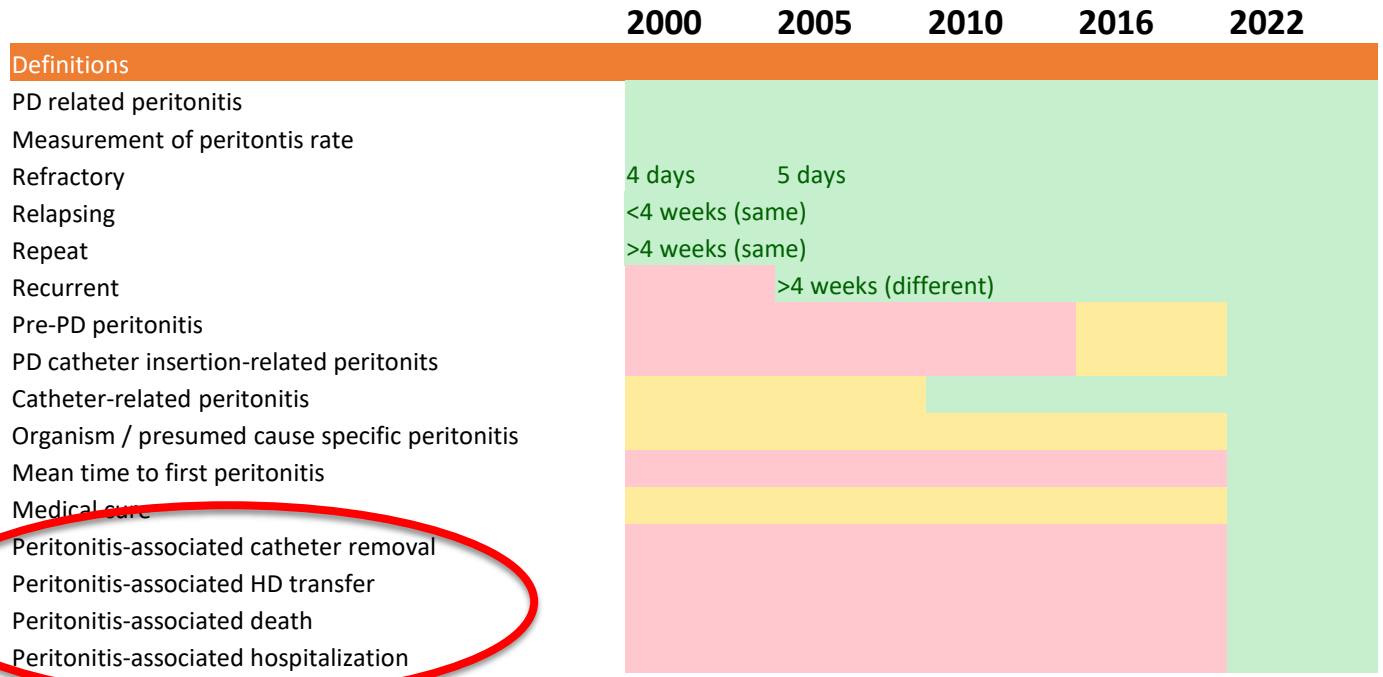
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# Guideline – major elements

- Definitions

- Monitoring

| | 2000 | 2005 | 2010 | 2016 | 2022 |
|---|---|---|---|---|---|
| Monitoring | | | | | |
| Monitoring of PD peritonitis rate | | 0.67 | 0.67 | 0.5 | 0.4 |
| % of patients free of peritonitis per year | | | | | 80% |
| Organism / presumed cause specific peritonitis rate | | | | | |
| Time to first peritonitis | | | | | |
| Monitoring response to peritonitis treatment | | | | | |
| PD catheter insertion-related peritonitis | | | | | <5% |
| Culture negative peritonitis | | 20% | 20% | 15% | 15% |
| Root-cause review of each peritonitis | | | | | |
| Programmatic CQI | | | | | |

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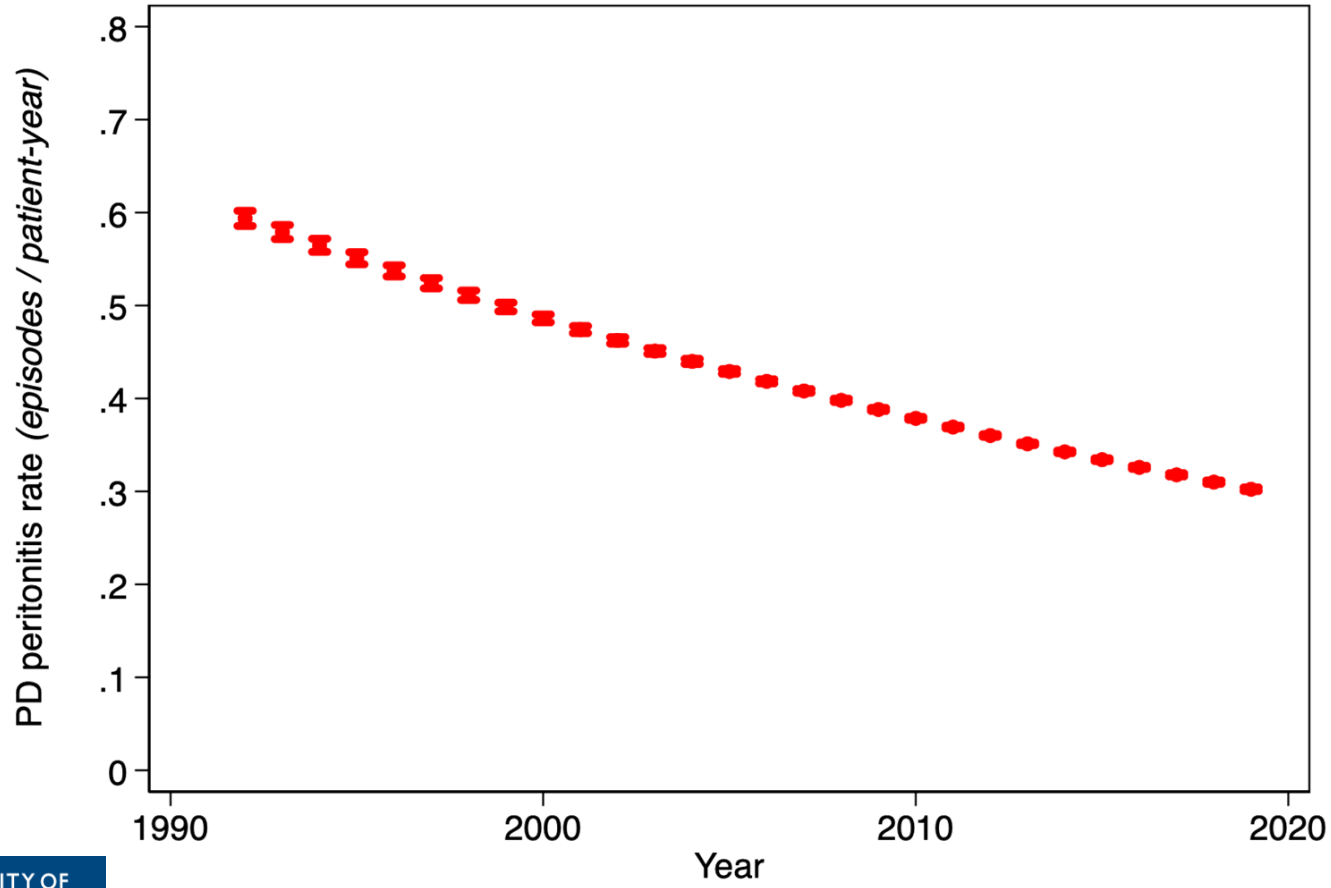
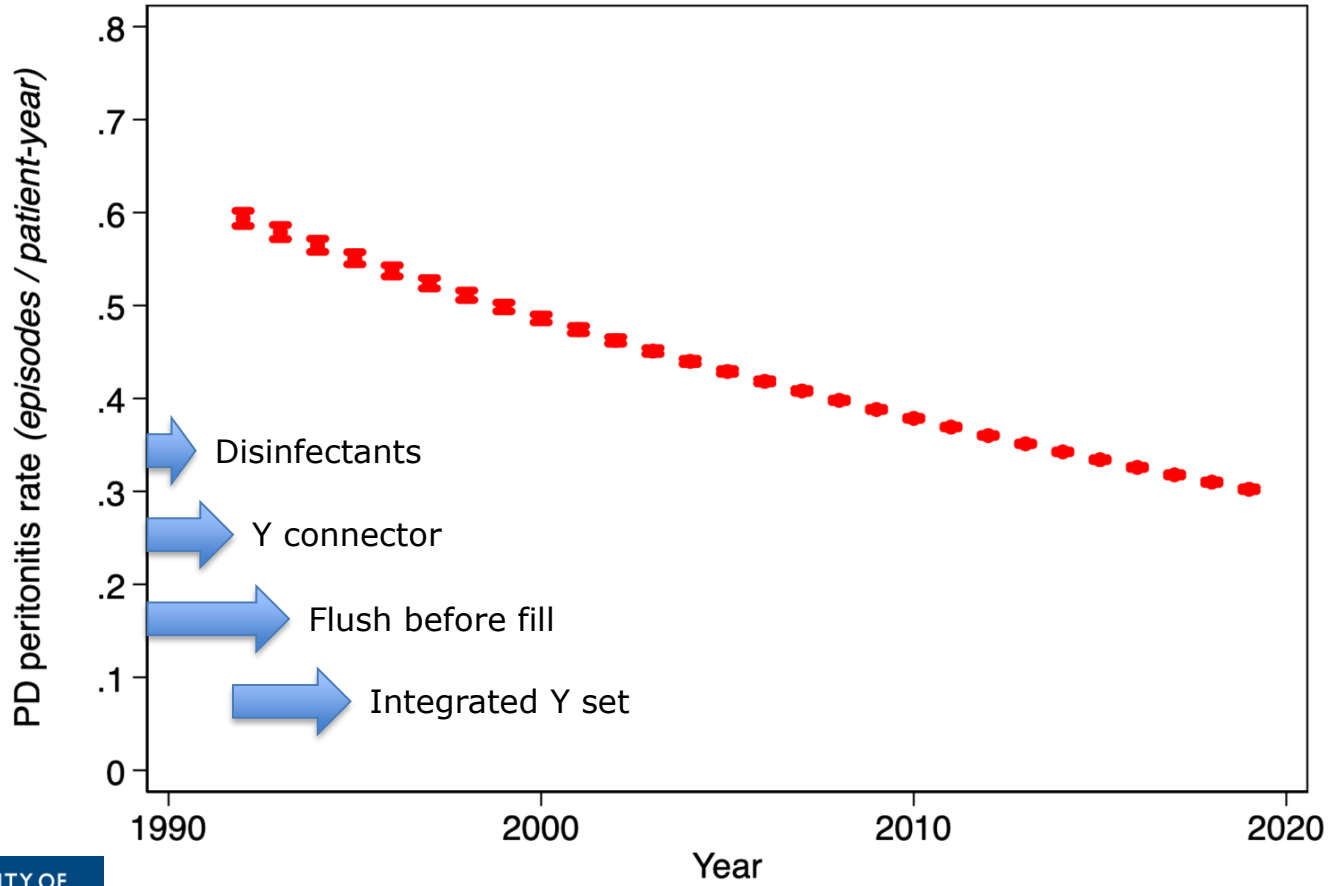



*Random-effects Poisson model of aggregated data from 33 national registries*

Marshall MR. A systematic review of peritoneal dialysis-related peritonitis rates over time from national or regional population-based registries and databases. Perit Dial Int. 2022 Jan;42(1):39-47. https://doi.org/10.1177/0896860821996096

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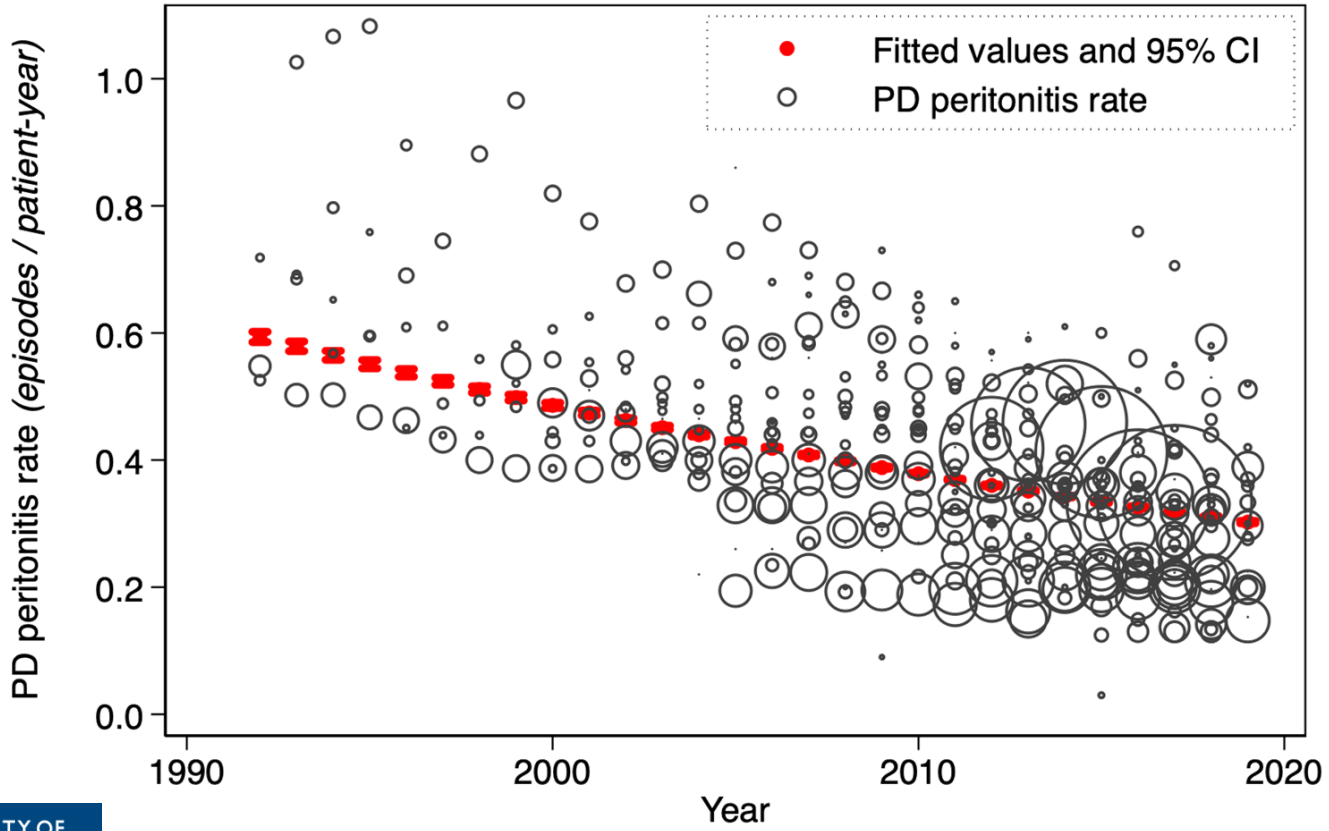


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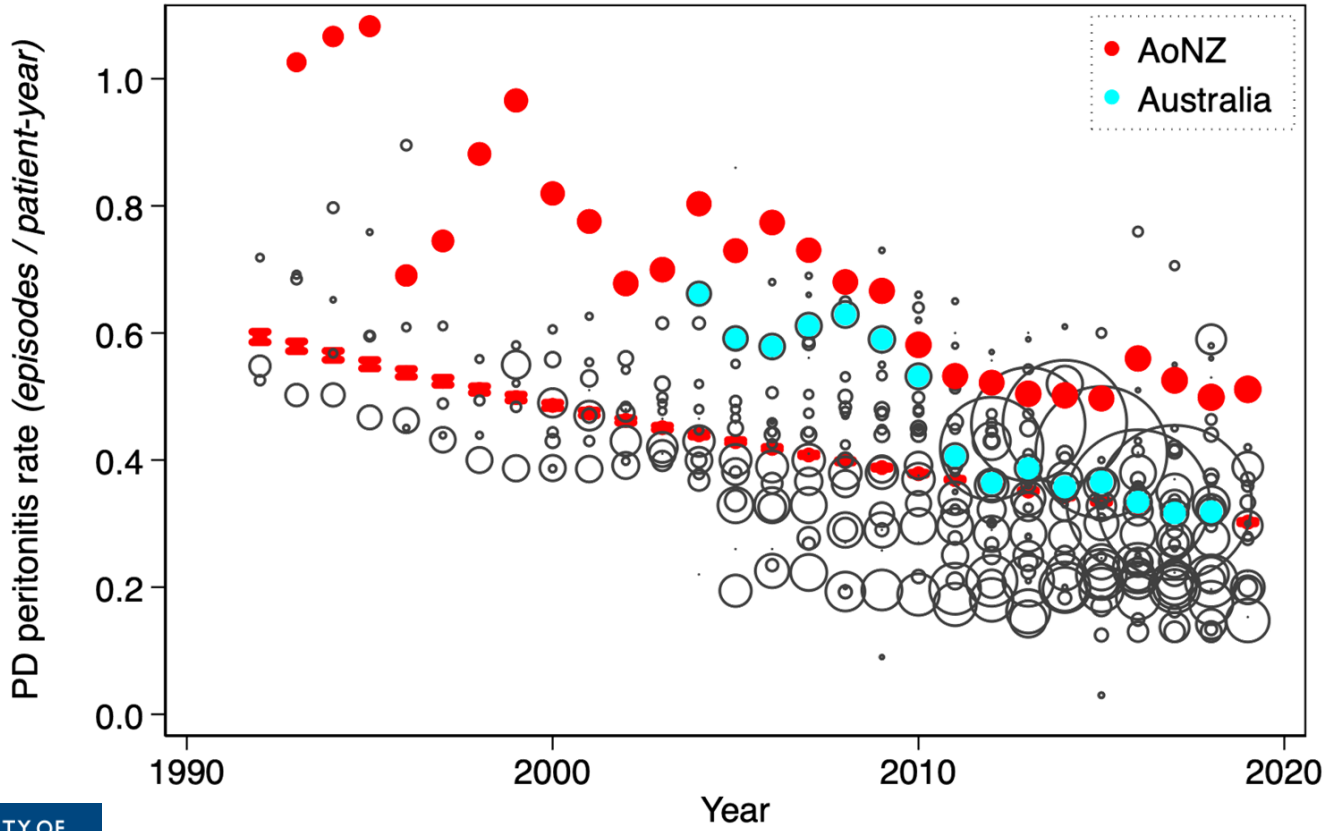


*Random-effects Poisson model of aggregated data from 33 national registries*

# PD peritonitis rate

- **ISPD Standard**: < 0.40 episodes per patient-year

- There is probably still an excess of preventable PD peritonitis in centres with ostensibly acceptable PD peritonitis rates

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# % patient free of peritonitis / year

- The majority of infections occur in a minority of patients
  - This measure reduces the impact of **patients who get peritonitis frequently** that choose to stay on PD for whatever reasons
  - Can draw focus to those with repeat or recurrent episodes

- Calculation
  - Numerator is **patients** who get peritonitis per year
  - Denominator is **patient-year**

# % patient free of peritonitis / year

% patient free of peritonitis / year

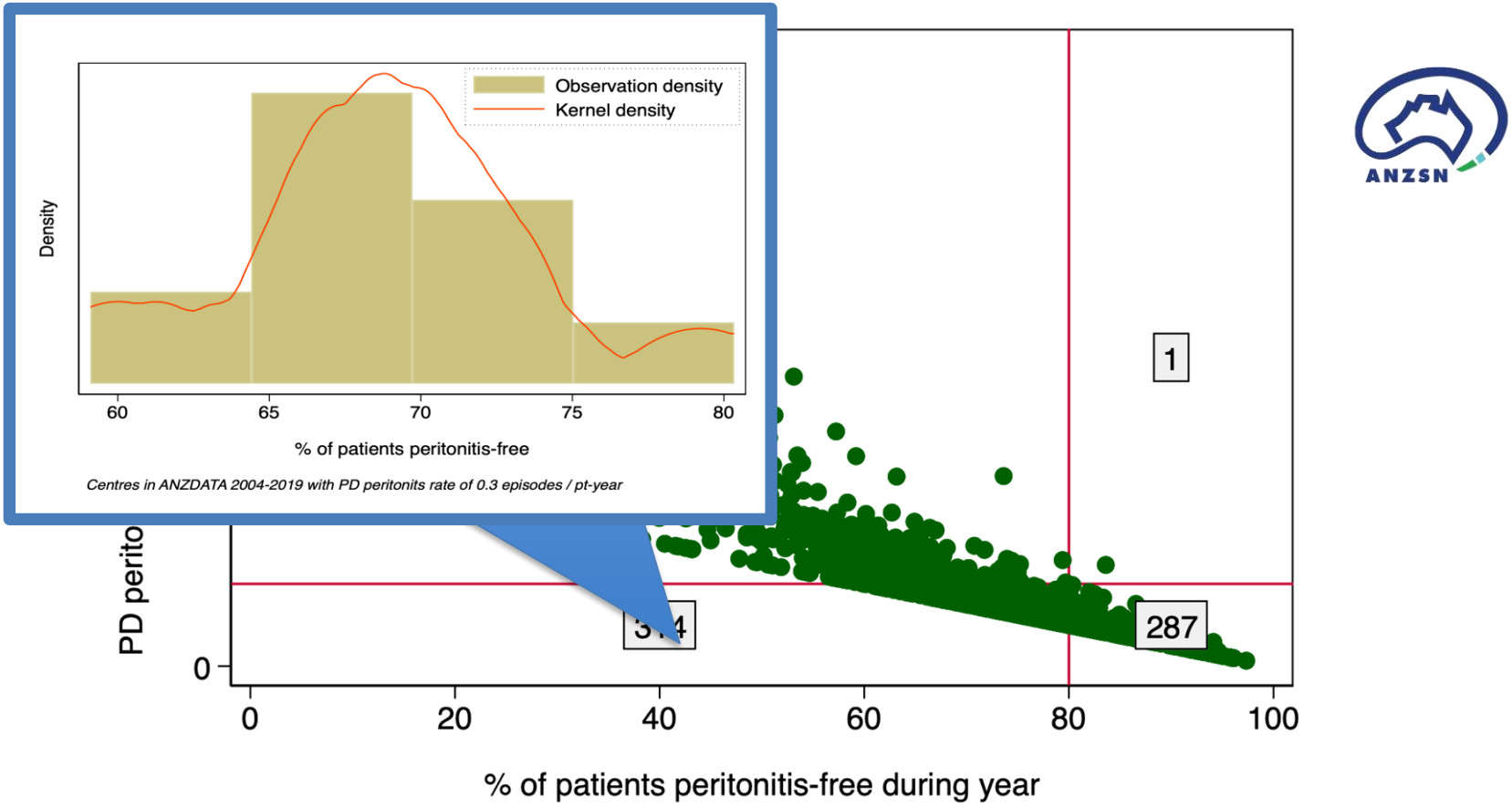
and

PD peritonitis rate

are **mathematically coupled**

# Thought experiment

- Assume your unit of 100 patients has a peritonitis rate of 0.4 episodes / patient-year
    - If everyone gets a maximum of one peritonitis a year, 60% will remain free ☹
    - If 20% of patients get 2 episodes per year, 80% will remain free ☺
    - If 10% of patients get 3 and 10% get one episode, 80% will remain free ☺




*1084 years for centres in ANZDATA 2004-2019*

# % patient free of peritonitis / year

- **ISPD Standard:** > 80 % of patients

- Needs further tailoring to ANZ ecosystem

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# Presumed cause-specific peritonitis

- Enteric peritonitis has different risk factors and preventative measures

- **Utility as a programmatic KPI is uncertain**

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# Mean time to first peritonitis

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# Medical cure

- **Definition:** resolution of peritonitis without
  - death
  - relapse / recurrent (*sic – should be repeat*) peritonitis
  - catheter removal
  - transfer to HD for ≥ 30 days

- **ISPD recommendation:** reported regularly

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# Summary

- Update on peritonitis (*new antibiotic recommendations*)
  - **New ISPD PD peritonitis standards**
    - < 0.40 episodes per patient-year
    - >80% of patients remaining peritonitis-free per patient-year
- New initiatives
  - Integrate the other ISPD Guidelines into protocols
  - Start reporting programmatic **catheter-related peritonitis and ESI rates**
  - Start reporting programmatic **medical cure rates**

# Summary

- Underused initiatives
  - **Root-cause** review of each episode peritonitis
  - Programmatic **CQI**

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# Ngā mihi nui!

# Guidelines

- Not policies
- Policies are standards that **mandates**, specifies, or prohibits conduct
    - Like the word “police”, it is derived from the Latin politia, and in turn from Ancient Greek πολιτεία (politeía), all meaning “government”

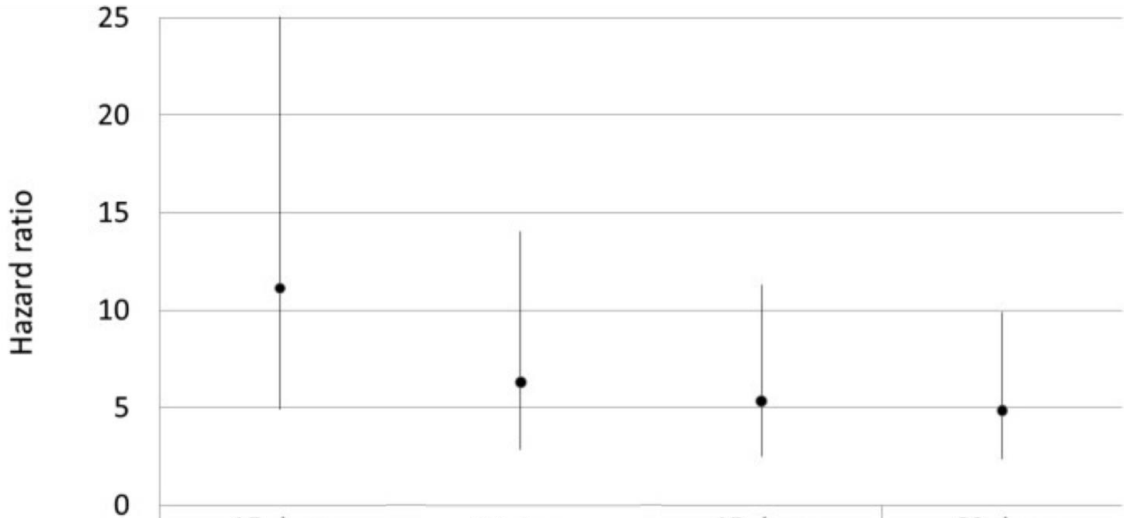
# Example

- In Japan, only 72% of PD peritonitis is treated with IP antibiotics, the rest IV +/- oral +/- IM +/- topical
- Cure rates are indistinguishable from other countries

Higuchi *et al.* Peritonitis in peritoneal dialysis patients in Japan: a 2013 retrospective questionnaire survey of Japanese Society for Peritoneal Dialysis member institutions. *Ren Replace Ther* **2**, 2 (2016). https://doi.org/10.1186/s41100-016-0014-6

Al Sahlawi *et al.* Variation in Peritoneal Dialysis-Related Peritonitis Outcomes in the Peritoneal Dialysis Outcomes and Practice Patterns Study (PDOPPS). Am J Kidney Dis. 2022 Jan;79(1):45-55.e1. https://doi.org/10.1053/j.ajkd.2021.03.022

Personal communication Prof Hideki Kawanishi, Ann Arbor (Brian Bieber, Charlotte Tu)




| | 15 days | 30 days | 45 days | 60 days |
|---|---|---|---|---|
| Hazard ratio[1] | 11.13 | 6.32 | 5.34 | 4.86 |
| High 95% CI | 25.07 | 14.03 | 11.30 | 9.91 |
| Low 95% CI | 4.94 | 2.85 | 2.52 | 2.39 |

Days after initial diagnosis ESI



van Diepen *et al*. The association between exit site infection and subsequent peritonitis among peritoneal dialysis patients. Clin J Am Soc Nephrol. 2012 Aug;7(8):1266-71 https://doi.org/10.2215/cjn.00980112