

# Antimicrobial Stewardship Strategy:

## Prospective audit with intervention and feedback

*Formal assessment of antimicrobial therapy by trained individuals, who make recommendations to the prescribing service in real time when therapy is considered suboptimal.*



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Priority Level: **A**

Difficulty Level: **3**

### Program Stage:

- Early
- Intermediate
- ✓ Advanced

### Antimicrobial Stewardship

#### Outcomes:

- Drug utilization outcomes
- Prescribing outcomes
- Reduction of *Clostridium difficile* infection

For more information on these criteria and how they were developed, please see the

[Antimicrobial Stewardship Strategy Criteria Reference Guide](#).

## Description

**This is an overview and not intended to be an all-inclusive summary. As a general principle, patients must be monitored by the health care team after changes to therapy resulting from recommendations made by the antimicrobial stewardship team.**

Prospective audit with intervention and feedback involves the assessment of antimicrobial therapy by trained individuals (usually physicians and/or pharmacists), who make recommendations to the prescribing service in real time when therapy is considered suboptimal.

Audits are often performed by trained pharmacists (infectious disease training is preferred but not essential<sup>1,2</sup>), ideally with physicians who have infectious disease expertise available for consultation on more complex cases.

It is important for pharmacists to have physician support, particularly at the beginning of a program and if the prescribers are unfamiliar with the antimicrobial stewardship pharmacist. This will help improve recommendation uptake by prescribers and increase pharmacist credibility. Physician support can include:

- Introduction of the antimicrobial stewardship program pharmacist to prescribers.
- Being readily available to the pharmacist for consultation and to meet with prescribers when required.
- Reinforcing pharmacists' recommendations.

The frequency of reviews will depend on staffing levels and can range from daily to weekly.

Program design can vary with respect to who performs the audits/provides feedback, when it is done, how often it is done, and for which patients it is performed. Options for patient selection can be based on one or more of the following criteria:

- Certain infectious conditions.
- Patient location or ward (e.g., intensive care unit) or admitting service (e.g., medicine, surgery, critical care).
- Specific antimicrobial agents (e.g., broad-spectrum, restricted, potentially toxic, high-use or documented or possible misuse, and/or costly antimicrobials. Common examples include vancomycin, carbapenems, linezolid, and piperacillin/tazobactam).
- Duration of therapy; common options include new antimicrobial prescriptions, specific days of therapy (e.g., day 3 or 7) or longer durations (e.g., day 7 or 10).
- Patients at high risk of complications (e.g., for *Clostridium difficile* infection).

Strategies for communication with prescribers can vary: ad hoc face-to-face or phone conversations, regularly scheduled stewardship rounds, and/or notes or consults in the chart.

There is variation in institutions' practice related to the documentation and permanency of recommendations made by the stewardship team in charts; no standard exists.

## Advantages

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- One of the two core stewardship strategies recommended in the Infectious Diseases Society of America/Society for Healthcare Epidemiology of America guidelines.<sup>3</sup>
- Has been shown to decrease unnecessary or inappropriate use of antimicrobials.
- Can be initiated as part of a physician's or pharmacist's current scope of practice without creating new protocols or guidelines.
- May be more acceptable to prescribers than restriction-based strategies, because it does not impede initiation of therapy and prescribers can choose whether or not to implement recommendations.
- May take place throughout the course of the patient's therapy and thus may impact many aspects of optimizing antimicrobial therapy such as duration, intravenous to oral conversion, de-escalation/streamlining, etc.
- Feedback component provides education to prescribers.
- Implementation is flexible, and the approach can be adapted to an institution's resources and antimicrobial issues.

## Disadvantages

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- Resource-intensive: staffing and time for review and communication of recommendations.
- Suggestions may not be accepted, which may reduce impact.
- Acceptance of suggestions may be affected by who gives the recommendation (e.g., higher likelihood of acceptance from a physician vs. a pharmacist and/or if the individual known to the prescriber).
- Uptake of recommendations may be slow until prescribers become familiar with and confident in stewardship personnel.

- Physician staff may be reluctant to advise on other physicians' patients or on patients they have not personally assessed.
- Prescribers may be concerned about liability related to acceptance or non-acceptance of recommendations made by stewardship personnel.

## Requirements

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- Dedicated staff to perform audit and feedback.
- Information technology resources (ideally automated) to identify the target population for review.
- Information management resources to efficiently document in a readily retrievable format for continuous assessment/follow-up.

## Associated Metrics

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- Measures of drug utilization (defined daily dose, days of therapy) and/or cost of all or targeted antimicrobials, duration of intravenous antimicrobials.
- Types of recommendations made by the antimicrobial stewardship program (e.g., changing dose or duration, de-escalation/streamlining, discontinuation).
- Acceptance rate of recommendations.

## References

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1. Trivedi KK, Kuper K. Hospital antimicrobial stewardship in the nonuniversity setting. *Infect Dis Clin North Am.* 2014;28(2):281–9.
2. Waters CD. Pharmacist-driven antimicrobial stewardship program in an institution without infectious diseases physician support. *Am J Health Syst Pharm.* 2015;72(6):466–8.
3. Dellit TH, Owens RC, McGowan JE Jr, Gerding DN, Weinstein RA, Burke JP, et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clin Infect Dis.* 2007;44(2):159–77. Available from: <http://cid.oxfordjournals.org/content/44/2/159.long>

## Additional Useful References

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**Select articles to provide supplemental information and insight into the strategy described and/or examples of how the strategy was applied; not a comprehensive reference list. URLs are provided when materials are freely available on the Internet.**

- Chung GW, Wu JE, Yeo CL, Chan D, Hsu LY. Antimicrobial stewardship: a review of prospective audit and feedback systems and an objective evaluation of outcomes. *Virulence.* 2013;4(2):151–7. Available from: <http://www.tandfonline.com/doi/full/10.4161/viru.21626>

*Detailed review of prospective audit and feedback programs.*

- Toth NR, Chambers RM, Davis SL. Implementation of a care bundle for antimicrobial stewardship. *Am J Health Syst Pharm.* 2010;67(9):746–9.

*Assessed the impact of audit and feedback performed by a stewardship pharmacist on quality indicators of antimicrobial use.*

*Targeted patients receiving anti-pseudomonal beta-lactams, fluoroquinolones, vancomycin, linezolid and aminoglycosides.*

- Hamilton KW, Gerber JS, Moehring R, Anderson DJ, Calderwood MS, Han JH, et al. Centers for Disease Control and Prevention Epicenters Program. Point-of-prescription interventions to improve antimicrobial stewardship. *Clin Infect Dis.* 2015;60(8):1252–8. Available from: <http://cid.oxfordjournals.org/content/60/8/1252.long>

*Contains sample flowsheet that may be used to guide prospective audit and feedback.*

## Samples/Examples

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- [Example 1: Markham Stouffville Hospital Corporation - Antimicrobial Stewardship Team Suggestions Template](#)
- [Example 2: Royal Victoria Regional Health Centre - Patient Care System ASP Documentation Template](#)
- [Example 3: Royal Victoria Regional Health Centre - Antimicrobial Stewardship Team Chart Suggestion Stamp](#)
- [Example 4: The Scarborough Hospital - ICNet System Sample Report of Patients Ordered Antimicrobials for a Selected Unit](#)
- [Example 5: The Scarborough Hospital - ICNet System Sample Automated Alerts](#)
- [Example 6: SPIRES, Quality and Patient Safety, Vancouver Coastal Health – Target Drug Report](#)
- [Example 7: Peterborough Regional Health Centre - ASP Intervention Documentation Record](#)

***These documents have been generously shared by various health care institutions to help others develop and build their antimicrobial stewardship programs. We recommend crediting an institution when adopting a specific tool/form/pathway in its original form.***

***Examples that contain clinical or therapeutic recommendations may not necessarily be consistent with published guidelines, or be appropriate or directly applicable to other institutions. All examples should be considered in the context of the institution’s population, setting and local antibiogram.***

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## Links with Other Strategies

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- [Checklists](#)
- [De-escalation and streamlining](#)
- [Disease-specific treatment guidelines, pathways, algorithms and/or associated order forms](#)
- [Dose optimization](#)
- [Intravenous to oral conversion](#)
- [Prescriber education](#)
- [Scheduled antimicrobial reassessments \(“antibiotic time outs”\)](#)
- [Therapeutic drug monitoring \(with feedback\)](#)

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### For further information

[Antimicrobial Stewardship Program](#), Infection Prevention and Control, Public Health Ontario.

Email: [asp@oahpp.ca](mailto:asp@oahpp.ca)


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## Example 1: Markham Stouffville Hospital Corporation - Antimicrobial Stewardship Team Suggestions Template

**MARKHAM STOUFFVILLE HOSPITAL**  
☐ Markham Site    ☐ Uxbridge Site

**Antimicrobial Stewardship Team Suggestions**



Allergies:  
☐ NKA

Case reviewed on: \_\_\_\_\_ Presumptive diagnosis: \_\_\_\_\_

Based on information available in Meditech PCI and the patient's paper chart, we suggest the following modifications to your patient's antimicrobial therapy:

	Agree	No	Comments/Changes

**These changes are recommended based on:**

<input type="checkbox"/> Culture/sensitivity Data:	<input type="checkbox"/> Specific diagnosis
<input type="checkbox"/> Cost effective/narrower spectrum antimicrobial regimen	<input type="checkbox"/> Adequate treatment duration
<input type="checkbox"/> Side effects/adverse reactions/drug interactions	<input type="checkbox"/> Excellent PO bioavailability
<input type="checkbox"/> Guidelines/best practices	<input type="checkbox"/> Optimize dosage regimen
<input type="checkbox"/> Other: _____	

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Current and Past Antimicrobial Therapy**

Drug Regimen	Start Date	End Date

Completed by: \_\_\_\_\_ Date/Time: \_\_\_\_\_ Physician signature: \_\_\_\_\_ Date: \_\_\_\_\_

ANTSTS (11/10) (410109845 3/09) DTC approved (12/08)    white - Chart    Yellow - Pharmacy    Pink - Pharmacy

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## Example 2: Royal Victoria Regional Health Centre - Patient Care System ASP Documentation Template



Patient Care System - (ROV/ROV.TESTS.65/ROV.TESTS.65) - [REDACTED]

Adt, Patientone Aaaaa Zzz Bbbb

DOB: 02/04/1975 37 F

ht: 152.4 cm / wt: 58.4 kg / BSA: 1.60 m2 / BMI: 25.6 kg/m2

25B-Intensive Care Unit ICU-1 ADMIN

Allergy/Adverse: Horse Dander, INTEGRATION TESTING

Document: Antimicrobial Stewardship Prog

Mon, 4 Mar 2013 0844 by [REDACTED] Real Time

Therapy - Occurrence #1	
Day of Antibiotic Therapy	<input type="text"/>
Culture	<input type="radio"/> Positive <input type="radio"/> Negative
Source of Positive Culture	<input type="radio"/> Blood <input type="radio"/> Aspirate <input type="radio"/> Throat <input type="radio"/> Urine <input type="radio"/> Skin <input type="radio"/> Sputum <input type="radio"/> Stool <input type="radio"/> Other <input type="text"/>
Pathogen Name	<input type="text"/>
Antibiotic Class	<input type="radio"/> Aminoglycosides <input type="radio"/> Clindamycin <input type="radio"/> Penicillins <input type="radio"/> 3-Lactam/B-Lactamase Inhi <input type="radio"/> Daptomycin <input type="radio"/> Quinolones <input type="radio"/> Carbapenems <input type="radio"/> Rifampin <input type="radio"/> Cephalosporin 1st Gen <input type="radio"/> Jincoside <input type="radio"/> Sulfonamides <input type="radio"/> Cephalosporin 2nd Gen <input type="radio"/> Macrolides <input type="radio"/> Tetracyclines <input type="radio"/> Cephalosporin 3rd Gen <input type="radio"/> Nitroimidazole <input type="radio"/> Tigecycline <input type="radio"/> Clindamycin <input type="radio"/> Nitrofurantoin <input type="radio"/> Vancomycin
Other Antibiotic Therapy	<input type="text"/>
Recommendations	<input type="checkbox"/> Discontinue Therapy <input type="checkbox"/> Change to Narrow <input type="checkbox"/> No Change <input type="checkbox"/> IV to PO (policy) <input type="checkbox"/> Change to Broaden <input type="checkbox"/> Reassess in 24 hours <input type="checkbox"/> IV to PO (non policy) <input type="checkbox"/> Dose Optimization <input type="checkbox"/> Infectious Disease Consul <input type="checkbox"/> Duration Optimization <input type="checkbox"/> Dose Adjustment
Order Written on Physician Order Sheet	<input type="radio"/> Yes <input type="radio"/> No Comment: <input type="text"/>
Physician Accepted Recommendation	<input type="radio"/> Yes <input type="radio"/> No Comment: <input type="text"/>

Real Values Clear Add Insert Occurrence Continue Occurrence View Protocol Accepted Data Sign Get In

Return

Status Board  
Intentions  
Outcomes  
enrich  
IT Spreadsheet  
Facilities  
Special Panel  
Assign Care Pro  
Notes  
Process Plans  
Schedule  
EMR  
Orders  
Allergies  
Oncology  
Recall/Memo  
Patient Instrum  
Print  
Discharge  
Exit PCS

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## Example 3: Royal Victoria Regional Health Centre - Antimicrobial Stewardship Team Chart Suggestion Stamp

Royal Victoria  
Regional Health Centre

### PHYSICIAN'S ORDERS

PLEASE USE BALLPOINT PEN

ALLERGIES (provide details below):  
☐ NO KNOWN ALLERGY    ☐ MEDICATIONS    ☐ FOOD    ☐ ENVIRONMENTAL    ☐ LATEX

MEDICATIONS/FOOD		REACTION

Weight (kg): \_\_\_\_\_ Height (cm): \_\_\_\_\_

EOL - ENTERED ON LINE    K - ENTERED ON K  
 PMO - PROFILE MADE OUT    N - NOTED  
 PLEASE ENTER IN THIS COLUMN

DATE D/M/Y	TIME	ORDER SIGNATURE, PROFESSIONAL DESIGNATION	ACTION T SIGNATURE DATE AND
		<div style="border: 2px solid red; padding: 5px; text-align: center;"> <b>RVH</b>            Royal Victoria            Regional Health Centre  <b>Antimicrobial Stewardship Team</b>  <b>"Start Smart" ..... Then Focus"</b>  <b>Physician: Dr. G. DiDiodato</b>  <b>Pharmacist: Leslie McArthur</b>  <b>ASP Suggests:</b> </div>	

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## Example 4: The Scarborough Hospital - ICNet System Sample Report of Patients Ordered Antimicrobials for a Selected Unit



Sample report of patients currently on an antimicrobial for a selected unit.

**ICINET PHARMACY** You have 5 triggered alerts Alerts Reports Utilities Search for patients News My Profile Help Log out

Home Reports Saved reports My reports Daily Antimicrobial Use on (Active medications)

**Daily Antimicrobial Use on (Active medications)** Edit selection Save report

**Report parameters**

Patient	Age	Medication	Prescription start date	Prescription end date	Days on prescription	Ordering physician	MRP	MRP Speciality	Unit	Inpatient	Last MRP	Last Room	Last bed
	81	ceftAZidime 2000 MG VIAL (Fortaz)	25-Oct-2015 14:00	28-Oct-2015 14:01	0			Medicine		✓			
	88	levOFLOXacin 250 MG TAB (Levaquin)	26 Oct 2015 14:00	02 Nov 2015 14:01	0			Medicine		✓			
	67	ceTRIAXone 1000 MG VIAL (Rocephin)	23-Oct-2015 22:00	29-Oct-2015 22:30	2					✓			
	67	metronIDAZOLE 500 MG/100 ML BAG (Flagyl)	23-Oct-2015 22:00	30-Oct-2015 14:30	2					✓			
	69	Ertapenem 1 g Inj	22-Oct-2015 16:00	28-Oct-2015 23:59	3			Medicine		✓			
	50	CEFUROXIME AXETIL 500 MG TAB (Ceftin)	24-Oct-2015 09:00	28-Oct-2015 21:01	2			Medicine		✓			
	50	AZITHROMYCIN 250 MG TAB (Zithromax)	25-Oct-2015 12:00	28-Oct-2015 12:01	1			Medicine		✓			

95%

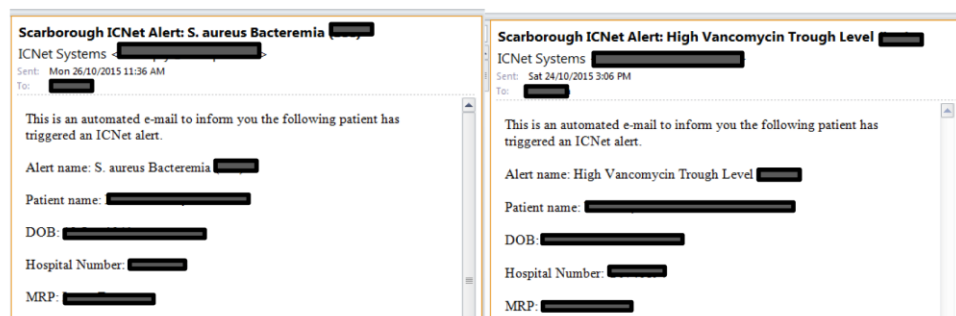
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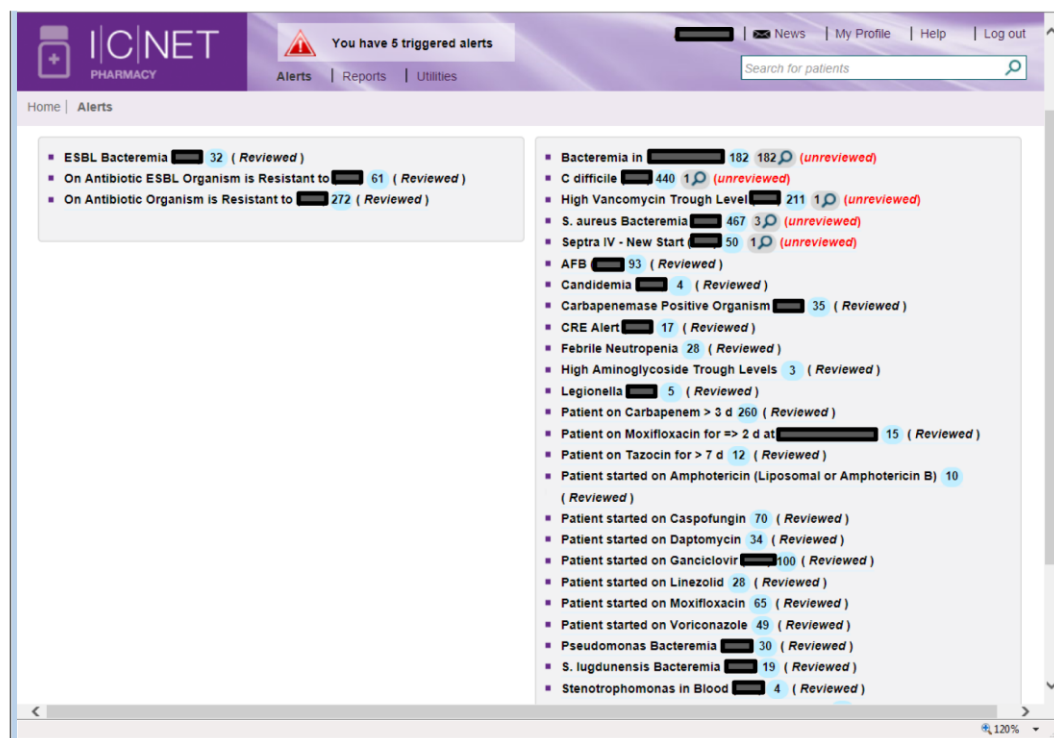
## Example 5: The Scarborough Hospital - ICNet System Sample Automated Alerts



### Sample Automated Email Alerts for +ve cultures or drug levels that exceed a predefined level



### Other alerts (browser view)



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## Example 6: SPIRES, Quality and Patient Safety, Vancouver Coastal Health – Target Drug Report



Site: VGH Ward: [REDACTED] Bed: [REDACTED] MRN: [REDACTED] Name: [REDACTED] DOB: [REDACTED] ( [REDACTED] yrs) Print Patient Report									
Admit Reason: ASPIRATION PNEUMONIA Attending: [REDACTED] Class: I Service: IMD Account: [REDACTED]									
Pharmacy Orders									
Order	Status	Drug	Details	Days on Order	Total Days	Tier	Start	End	Adjusted End
150	Active:NW:2015-11-12 12:03:00	piperacillin-tazobactam IV(PIPT3.375I)	3.375g iv every 6 hours&0600,1200,1800,2400 Reserved Antimicrobial Drug Important - Activate VIAL before use Shake well	1	3	6	2015-11-12 12:00:00	2015-11-15 18:00:00	2015-11-13 00:00:00
Recent Lab Results for MRN: [REDACTED] DOB: [REDACTED]									
Accession	Collected	Battery	Test	Result		Range			
[REDACTED]	2015-11-13 06:00:00	Complete Blood Count(CBC)	WBC Count(WBC)	3.7		4.0-11.0 X10 <sup>9</sup> /L		* L	
		Lytes,Urea,Cr(REN)	Creatinine(CR)	45		40-95 umol/L			
			Estimated GFR(EGFR)	130 New eGFR calculation (CKD EPI)		>59 mL/min			
[REDACTED]	2015-11-10 20:30:00	Respiratory culture(RESPI)	Specimen Description(SDES)	Tracheal aspirate					
			Special requests(SREQ)	None					
			Gram smear(GS)	3+ Polymorphs >25 epithelial cells per low power field 2+ Gram positive bacilli 2+ Gram negative bacilli Gram smear indicates specimen is contaminated with saliva.					
			Culture(CULT)	Light growth of: Mixed gram negative bacilli including Pseudomonas Moderate growth of: Normal respiratory flora					
			Report status(RPT)	Final 12Nov2015					
Site: VGH Ward: [REDACTED] Bed: [REDACTED] MRN: [REDACTED] Name: [REDACTED] DOB: [REDACTED] ( [REDACTED] yrs) Print Patient Report									
Admit Reason: PERFORATED AORTA Attending: [REDACTED] Class: I Service: IMD Account: [REDACTED]									
Pharmacy Orders									
Order	Status	Drug	Details	Days on Order	Total Days	Tier	Start	End	Adjusted End
[REDACTED]	Active:XO:2015-11-06 15:37:00	ampicillin IV(AMP12I)	2g iv every 6 hours&0600,1200,1800,2400 Shake and refrigerate	7	7	6	2015-11-06 18:00:00	2015-12-07 23:59:00	2015-11-13 00:00:00
Recent Lab Results for MRN: [REDACTED] DOB: [REDACTED]									
Accession	Collected	Battery	Test	Result		Range			
[REDACTED]	2015-11-13 07:18:00	Complete Blood Count(CBC)	WBC Count(WBC)	7.0		4.0-11.0 X10 <sup>9</sup> /L			
		Lytes,Urea,Cr(REN)	Creatinine(CR)	97		60-115 umol/L			
			Estimated GFR(EGFR)	57 New eGFR calculation (CKD EPI)		>59 mL/min		* L	

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**PRHC**  
Peterborough Regional  
Health Centre

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