



ADAPTIVE HEALTH INTELLIGENCE



EVIDENCE IN ACTION

Urinary tract infections (UTI) in children:

building a causal model-
based decision support tool
for diagnosis with domain
knowledge and prospective
data



Acknowledgements

Yue Wu

Steven Mascaro

Tom Snelling

Anita Campbell

David Foley

Ariel Mace

Paul Ingram

Meredith Bowland

Chris Blyth

Nick Larkins

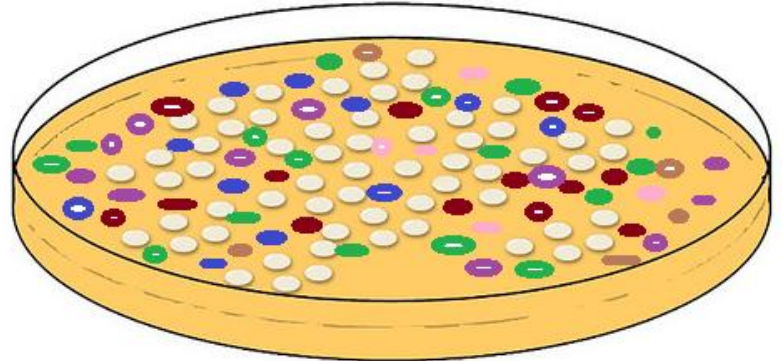
Tim Robertson

Phoebe Williams



UTI Infections in Kids

The clinical problem





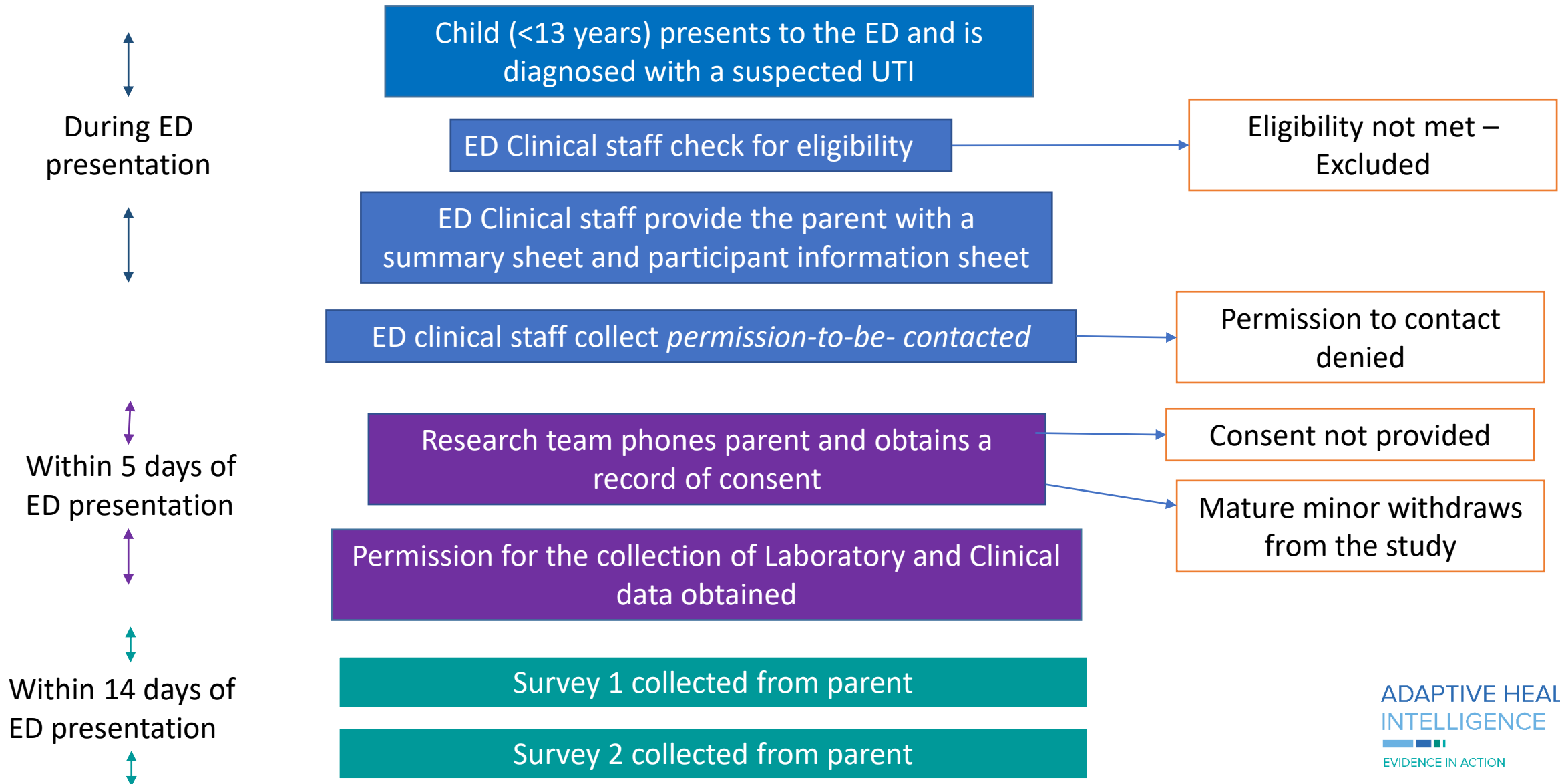
Need for Clinical Data

Development and prospective evaluation of a dynamic antibiogram to guide empiric antibiotic treatment of urinary tract infections in children

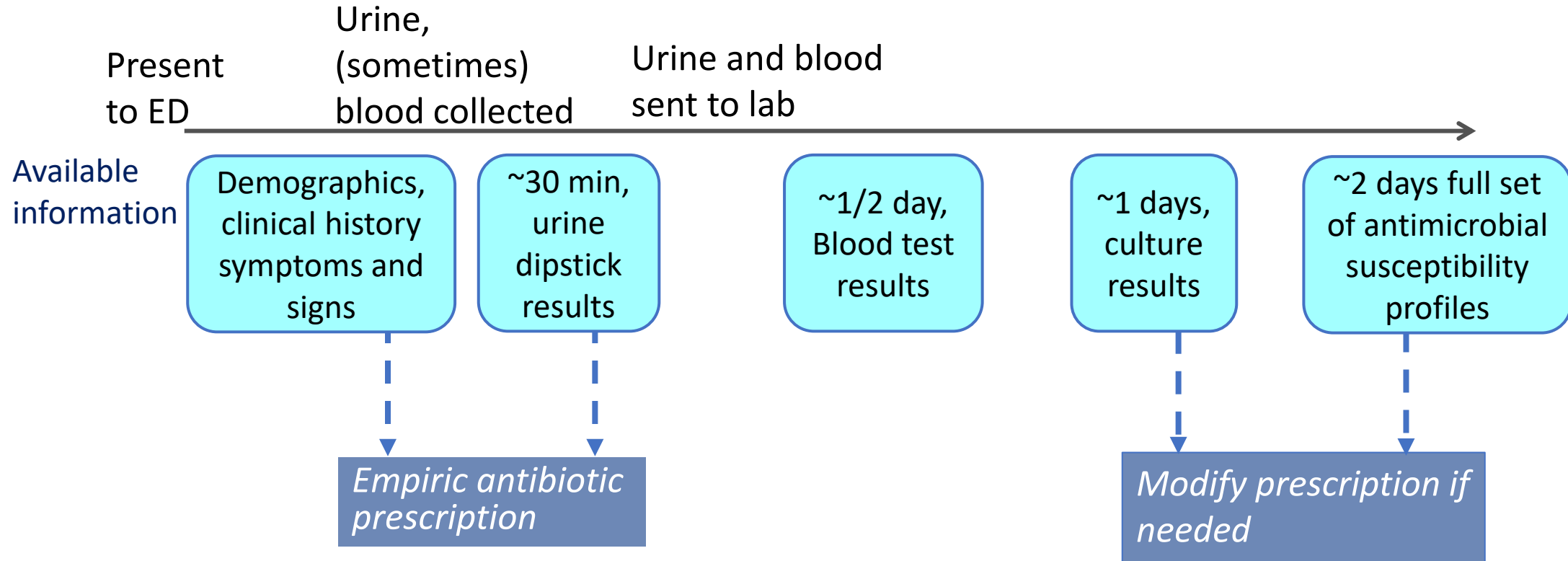


The PEA Study

Obtaining Clinical Data – The PEA Study

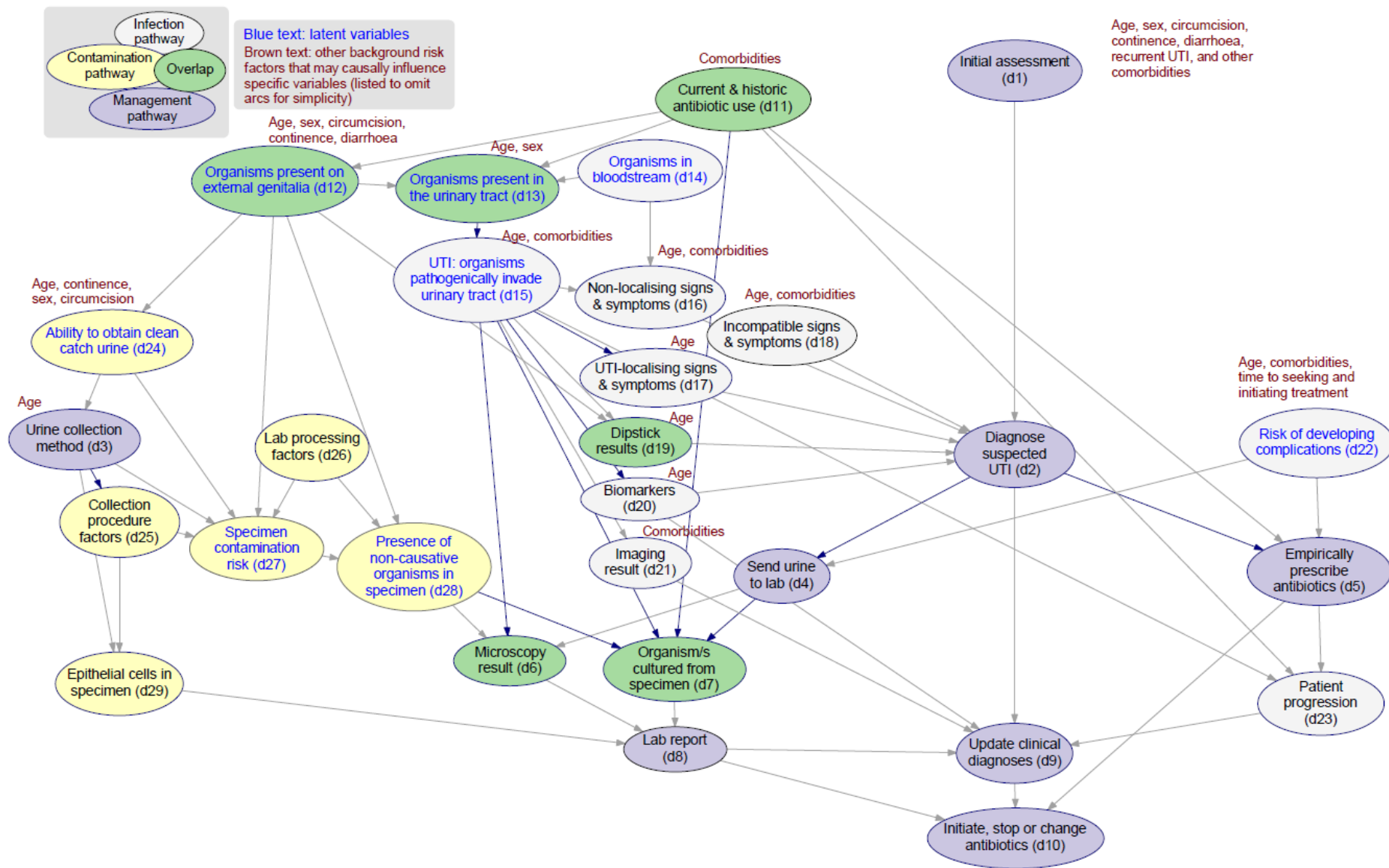


UTI clinical pathway

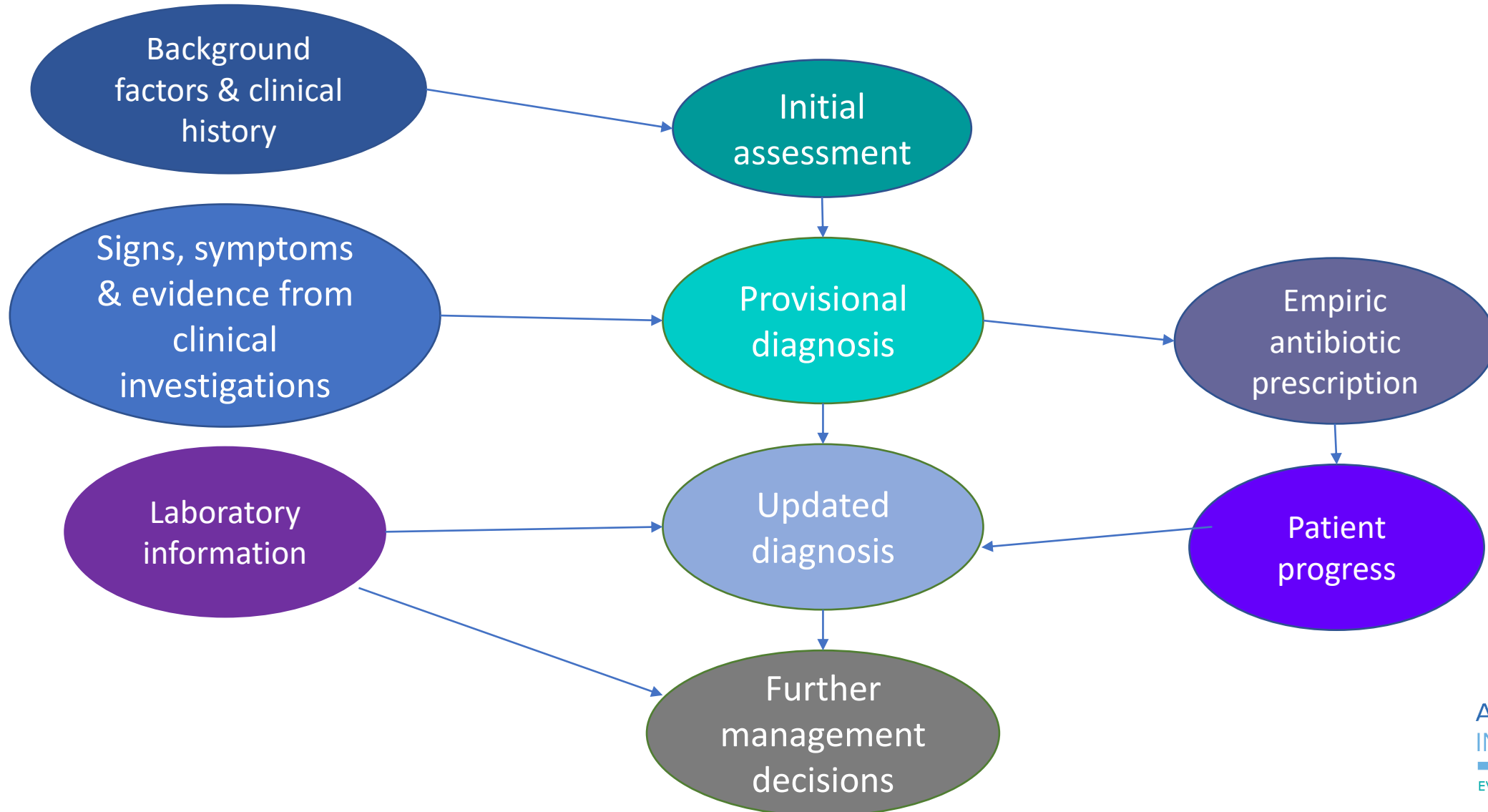


Building a solution

Expert DAG

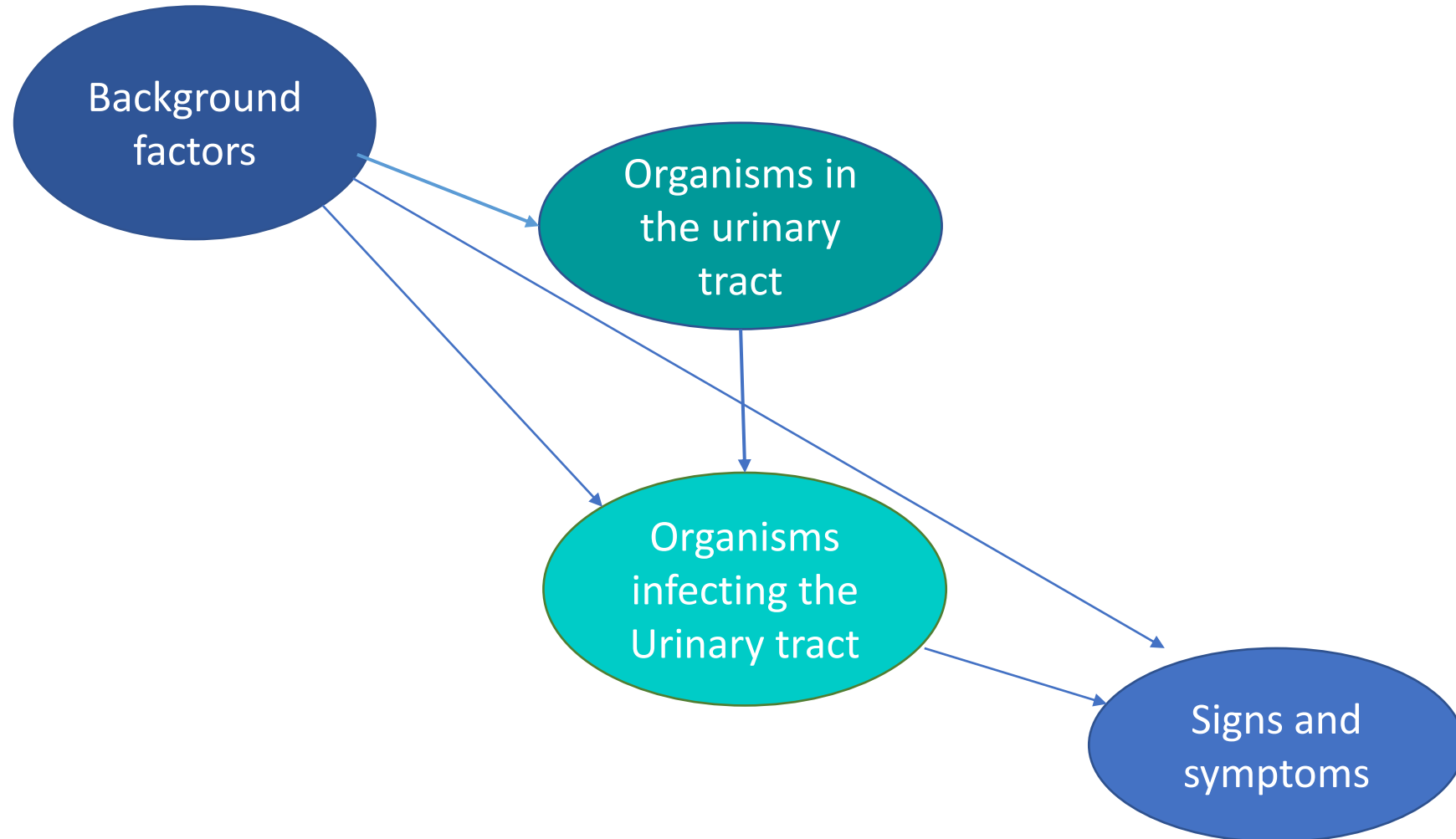


Expert DAG – Management Pathway

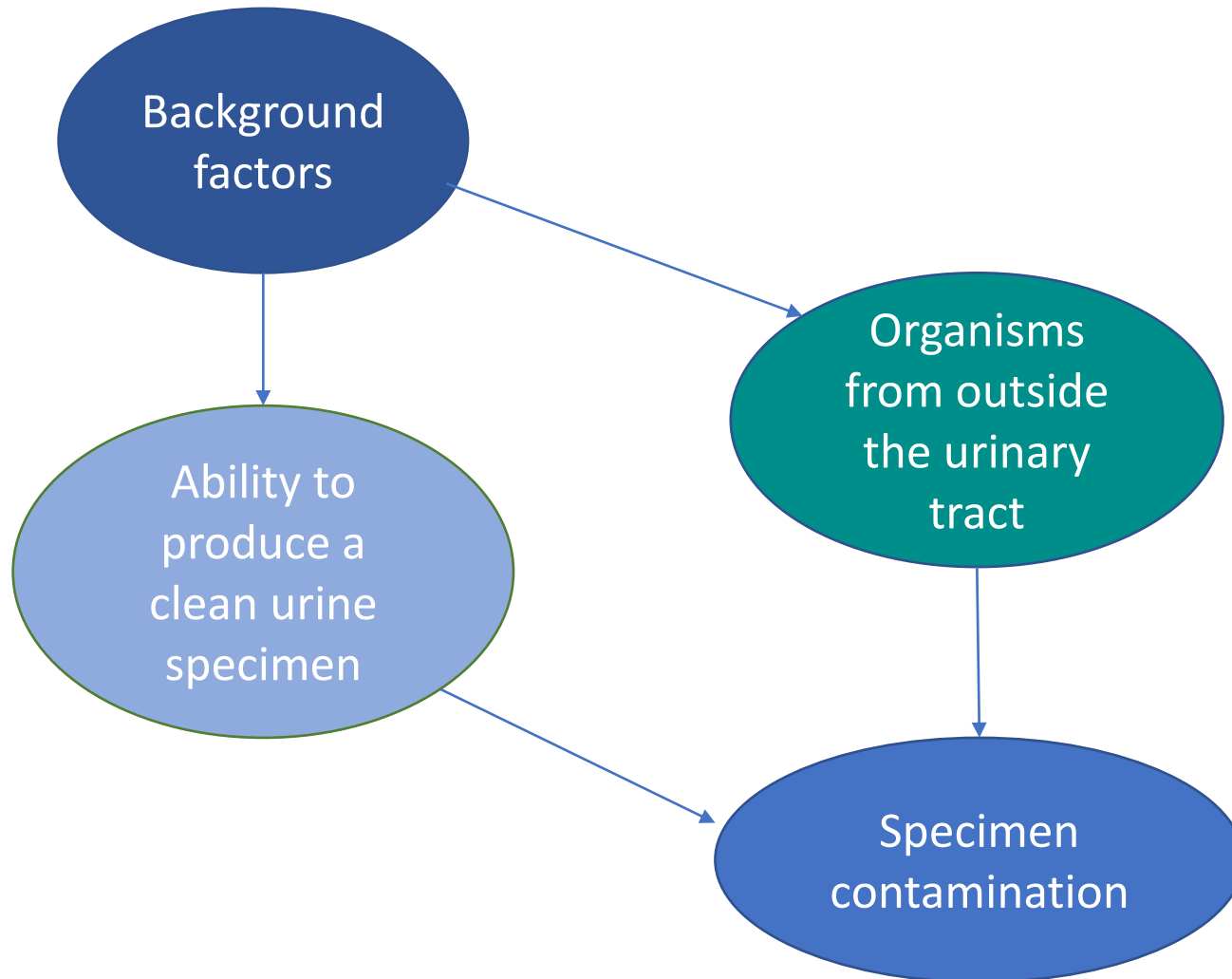




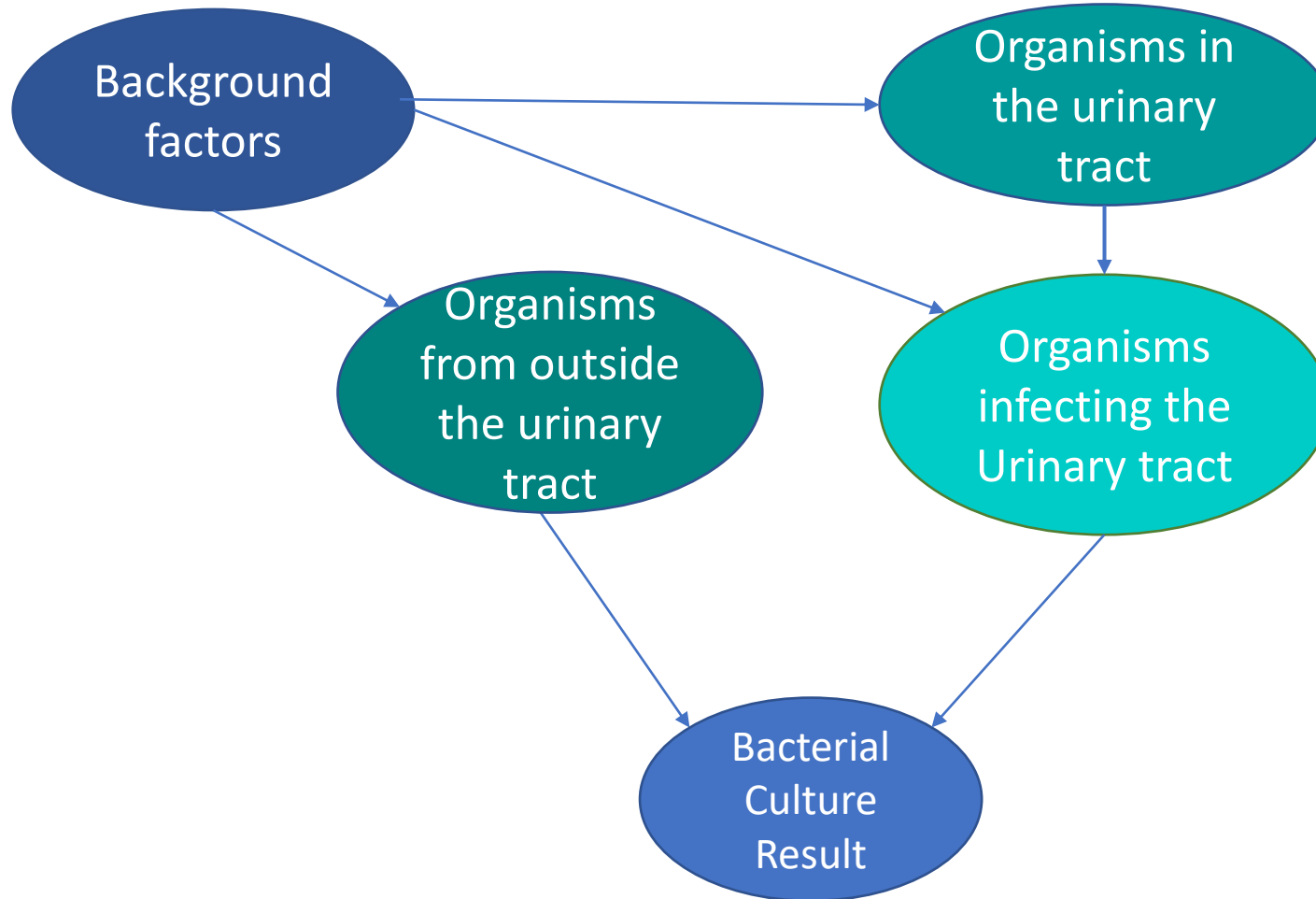
Expert DAG – Infection Pathway



Expert DAG – Contamination Pathway

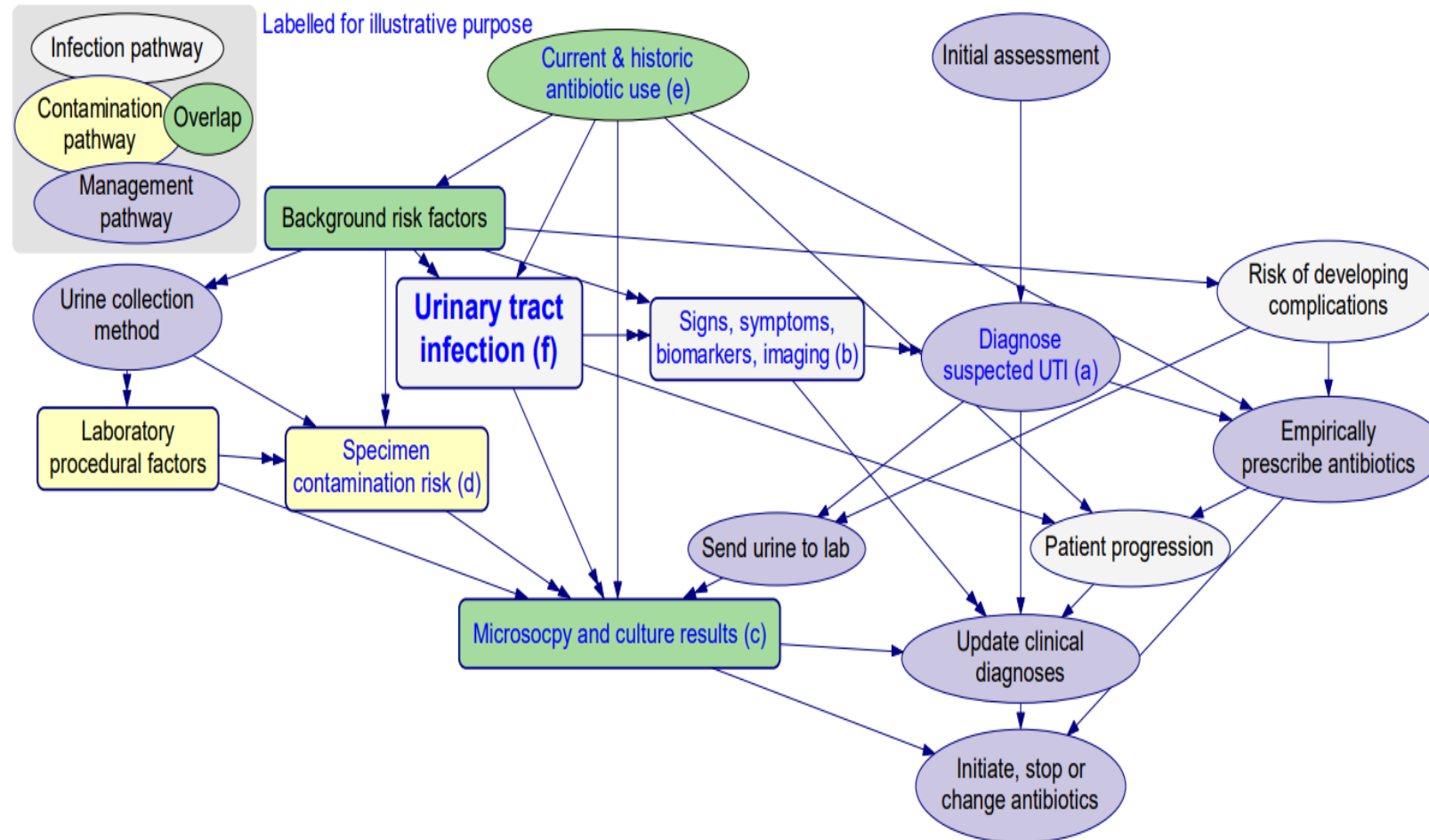


Expert DAG – Convergence of Pathways



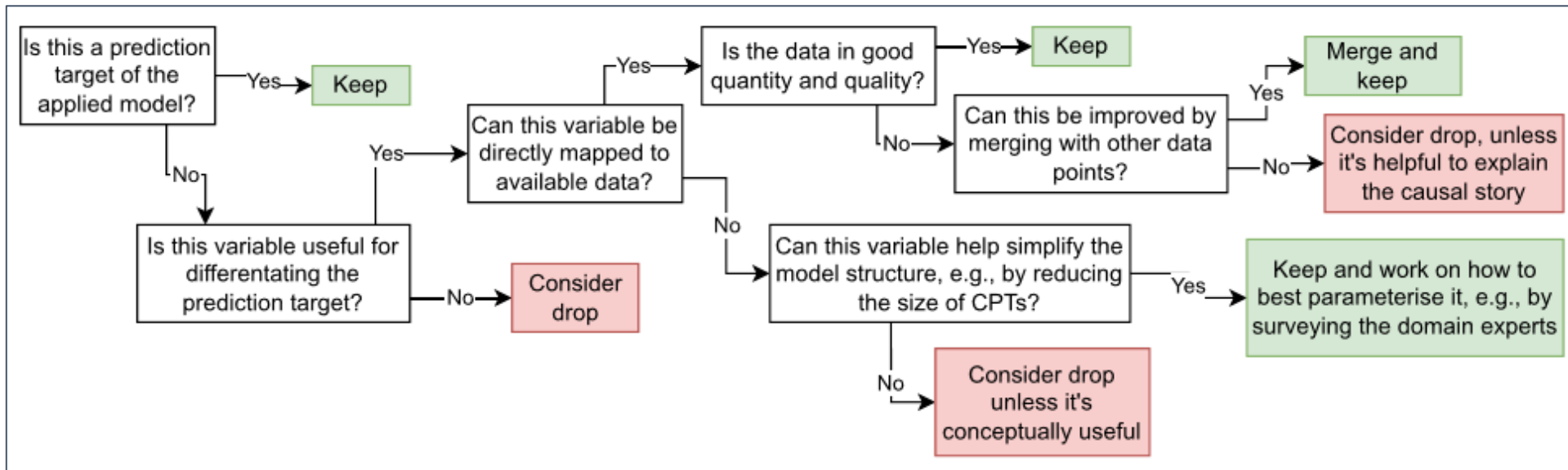
Developing the solution

Bayesian Network Model



Developing the solution

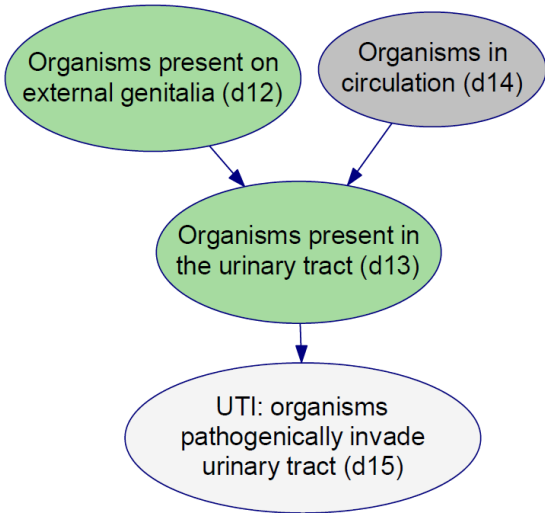
Bayesian Network Model



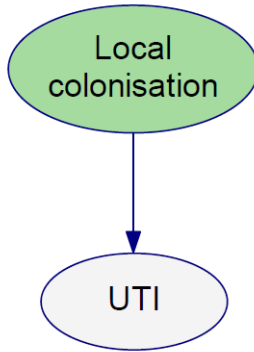
Developing the solution

Bayesian Network Model

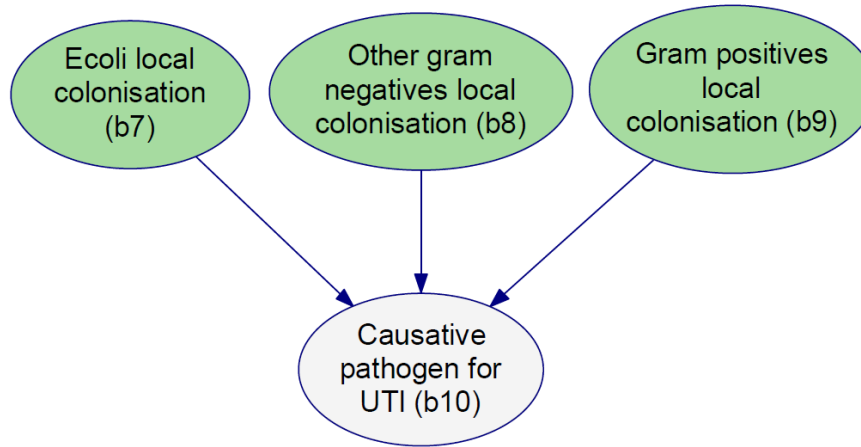
The Expert DAG



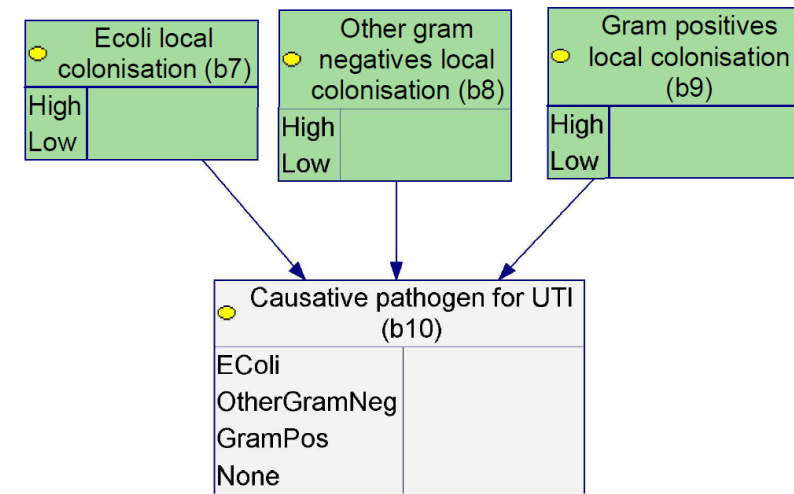
Simplification



Expasion for the Application BN



The Application BN with defined variable states



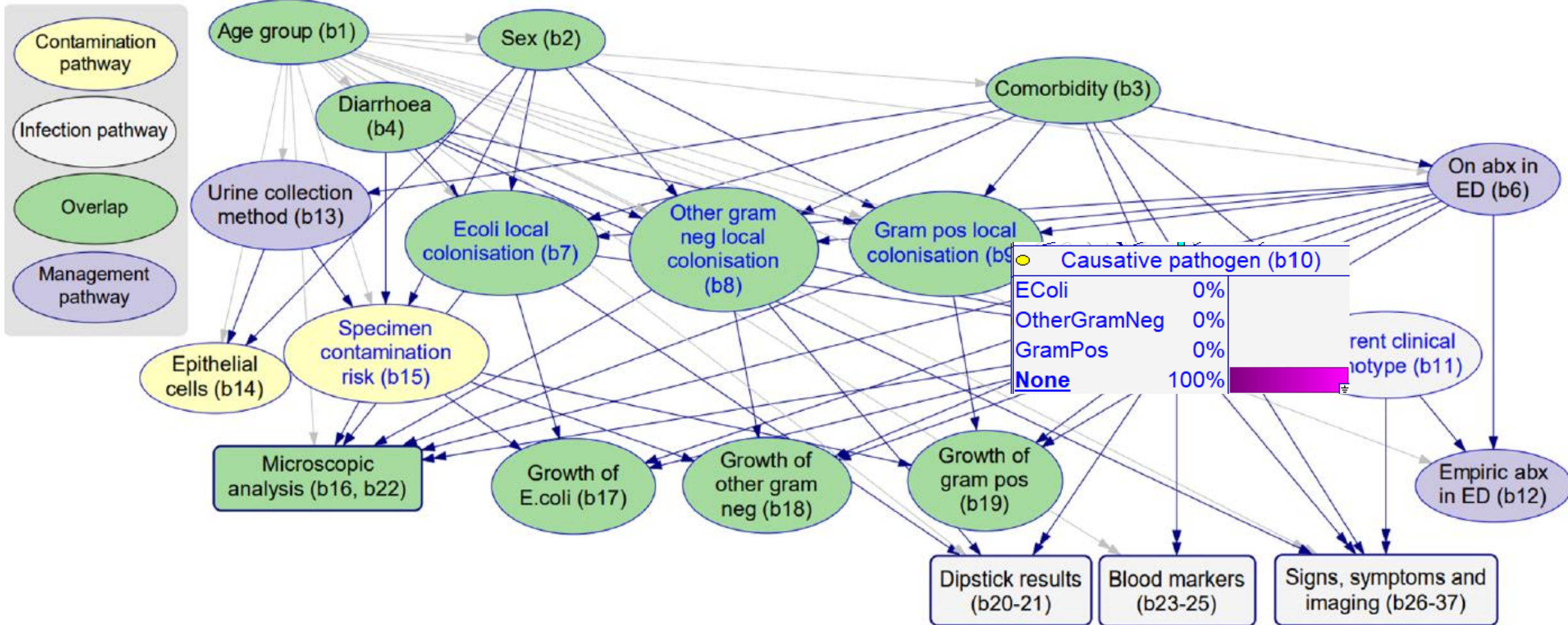
Kept

Re-organised

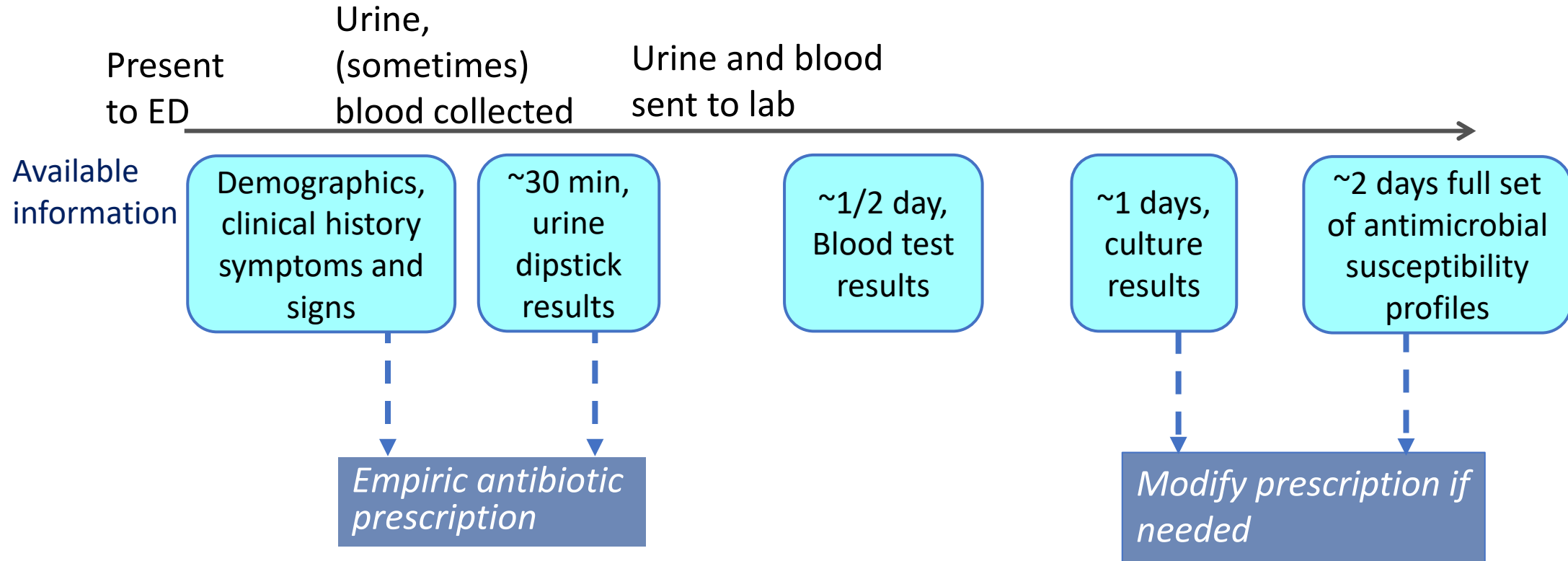
Removed

Developing the solution

Blue text: Latent variables

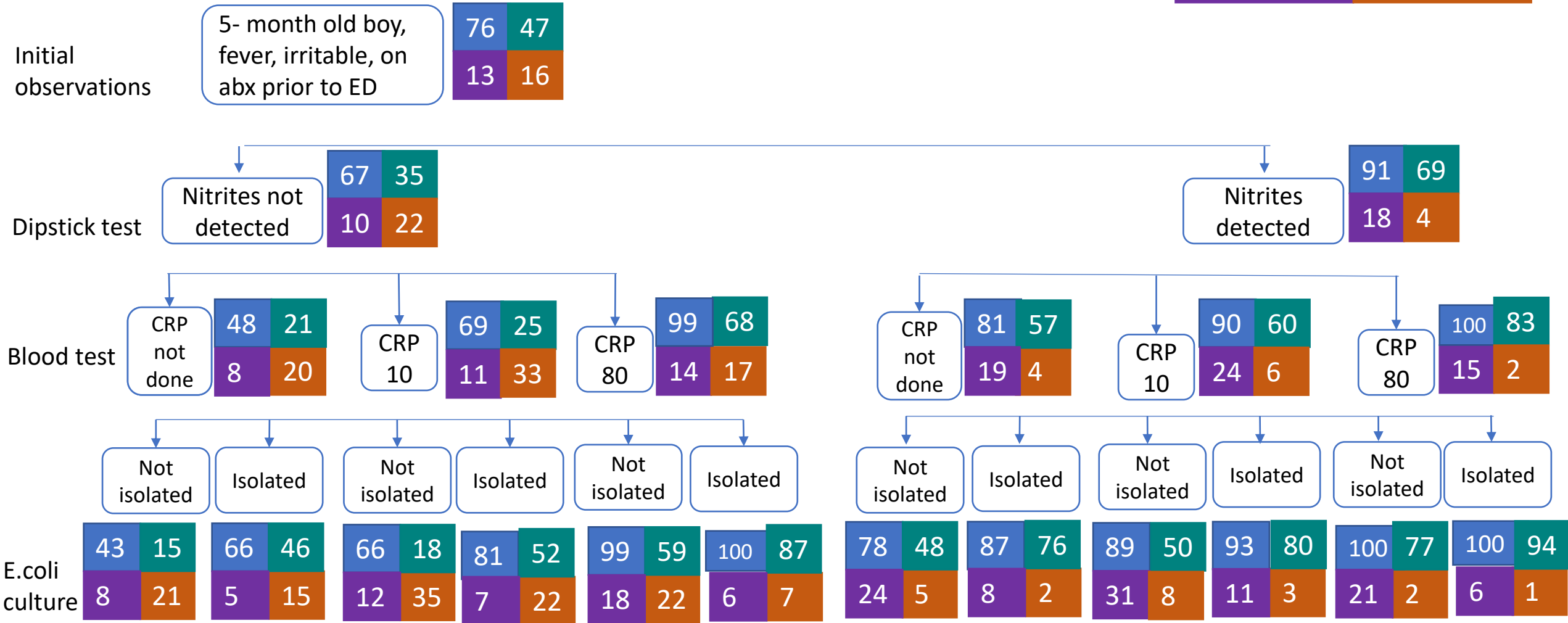


UTI clinical pathway



Clinical scenario

UTI	E.coli UTI
Other gram neg. UTI	Gram pos. UTI



Clinical scenario

B

BN predicted probabilities of UTI (%) among the PEA cohort:

UTI	E.coli UTI
Other gram neg. UTI	Gram pos. UTI

Initial observations

3-year-old girl, reported abdominal pain, burning, smelly urine, reported no fever

99	48
23	28

Further clinical investigation

No abnormal urinary tract

98	52
19	26

Abnormal urinary tract

99	46
25	28

Further clinical investigation

Temperature 37

98	65
13	20

Temperature 38

98	38
28	32

Temperature 37

99	59
18	22

Temperature 38

99	33
35	31

Dipstick test

Nitrites not detected

97	52
11	34

Nitrites detected

99	82
15	3

Nitrites not detected

97	27
22	48

Nitrites detected

99	56
39	5

Nitrites not detected

99	47
15	36

Nitrites detected

100	76
21	3

Nitrites not detected

99	24
28	47

Nitrites detected

100	47
48	6

Blood test

N'phils 5

100	30
24	40

N'phils 17

100	30
2	91

N'phils 5

98	56
39	4

N'phils 17

100	98
2	0

N'phils 5

95	13
38	45

N'phils 17

100	78
8	14

N'phils 5

100	3
24	4

N'phils 17

100	30
24	40

N'phils 5

100	25
49	4

N'phils 17

100	30
24	40

N'phils 5

100	46
49	4

N'phils 17

100	46
49	4

N'phils 5

100	30
24	40

N'phils 17

100	74
49	15

N'phils 5

100	30
24	40

N'phils 17

100	30
24	40

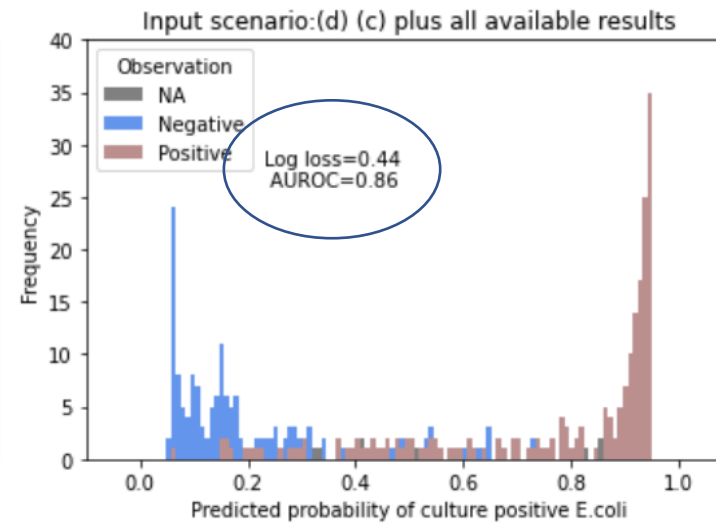
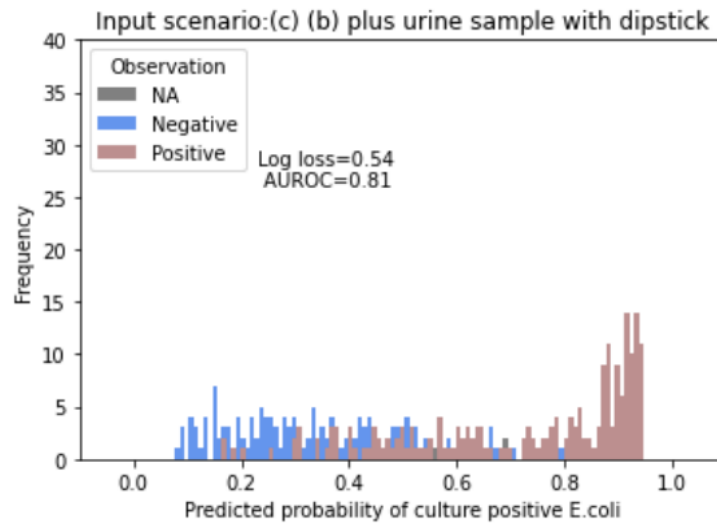
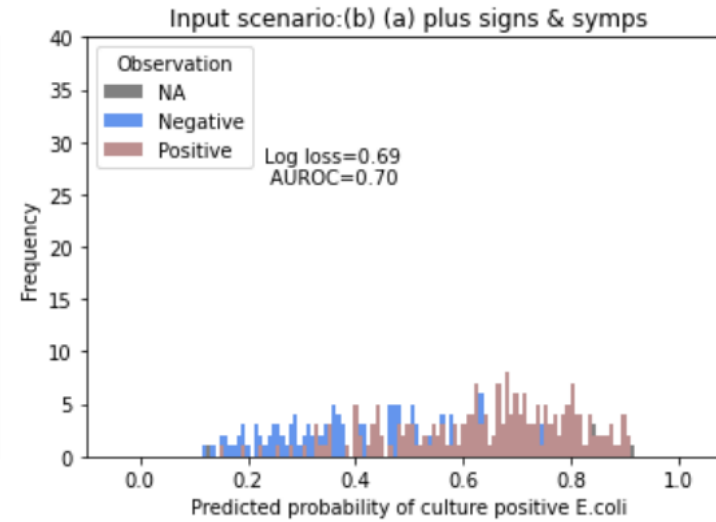
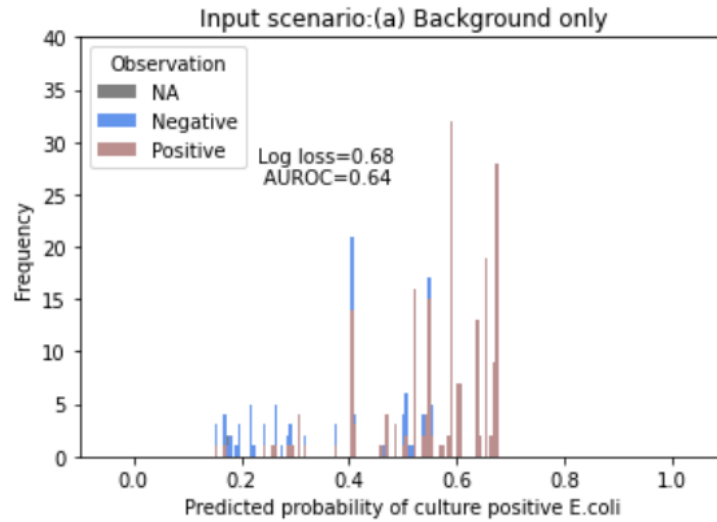
N'phils 5

100	30
11	1

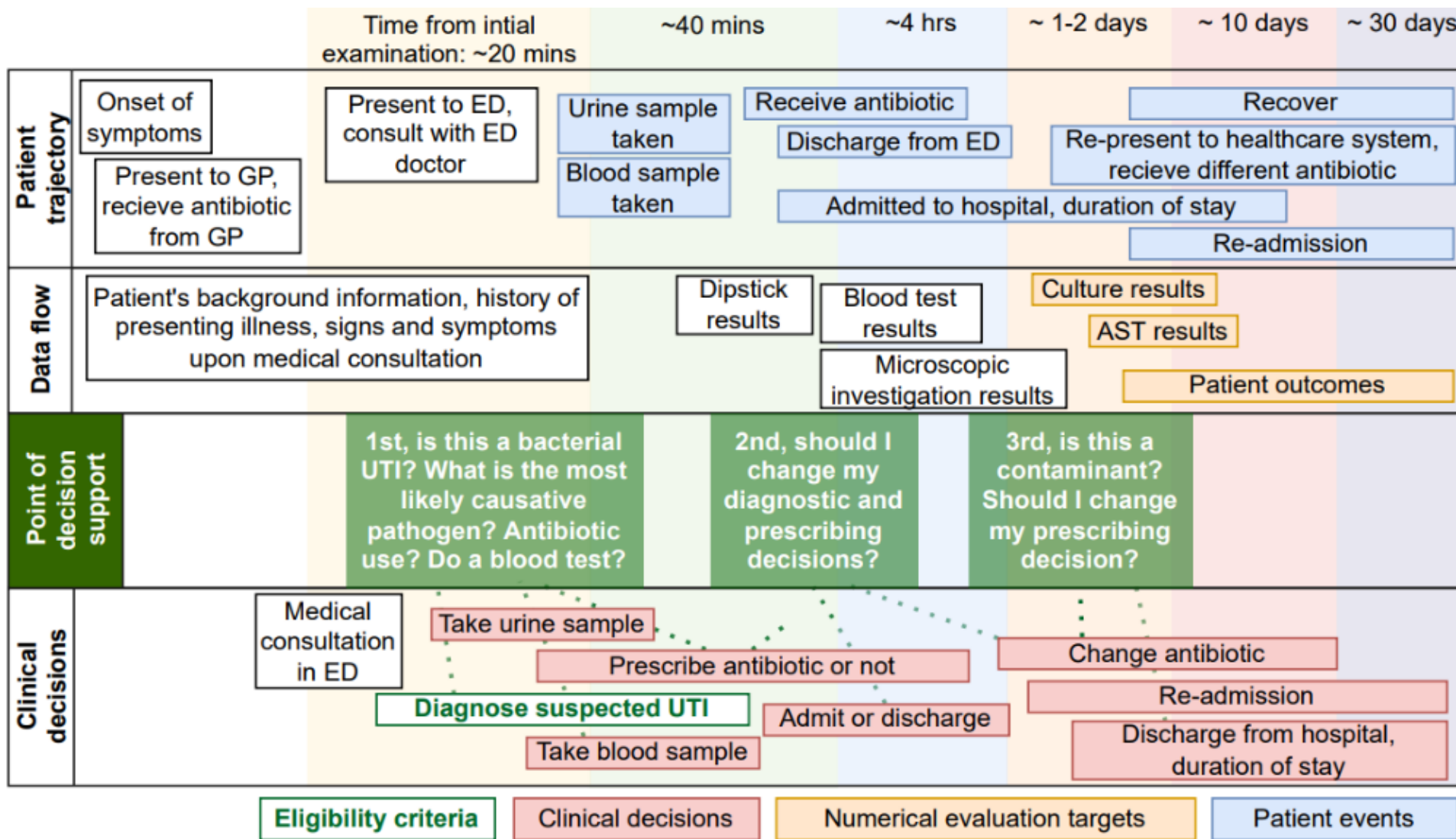
N'phils 17

100	88
11	1

Model performance

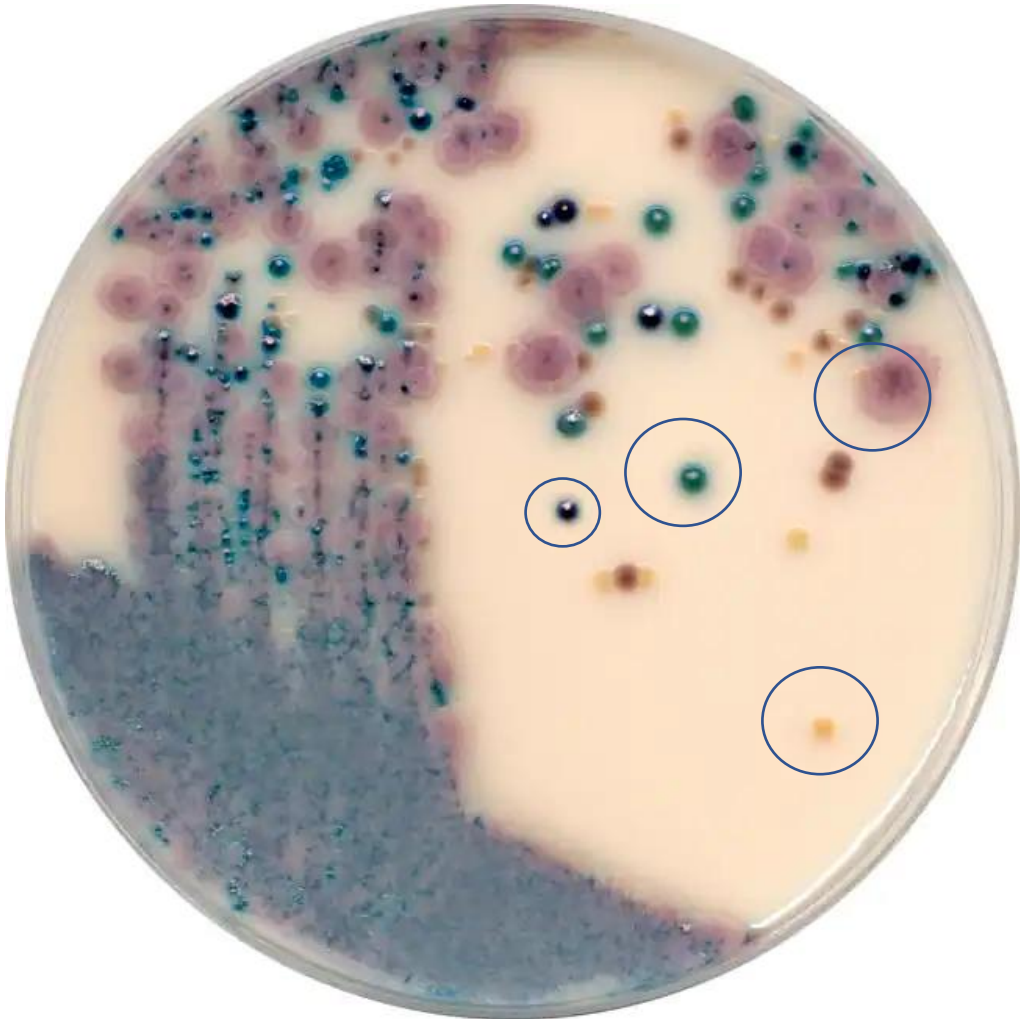


Implementation of a CDSS in clinical practice





Implementation of a CDSS in clinical practice



99	88
11	1

ADAPTIVE HEALTH INTELLIGENCE



EVIDENCE IN ACTION



WESFARMERS
CENTRE OF VACCINES
& INFECTIOUS DISEASES

Questions?

Jessica Ramsay

Jessica.ramsay@telethonkids.org.au