



Equine alimentary diseases (infectious)

Part A

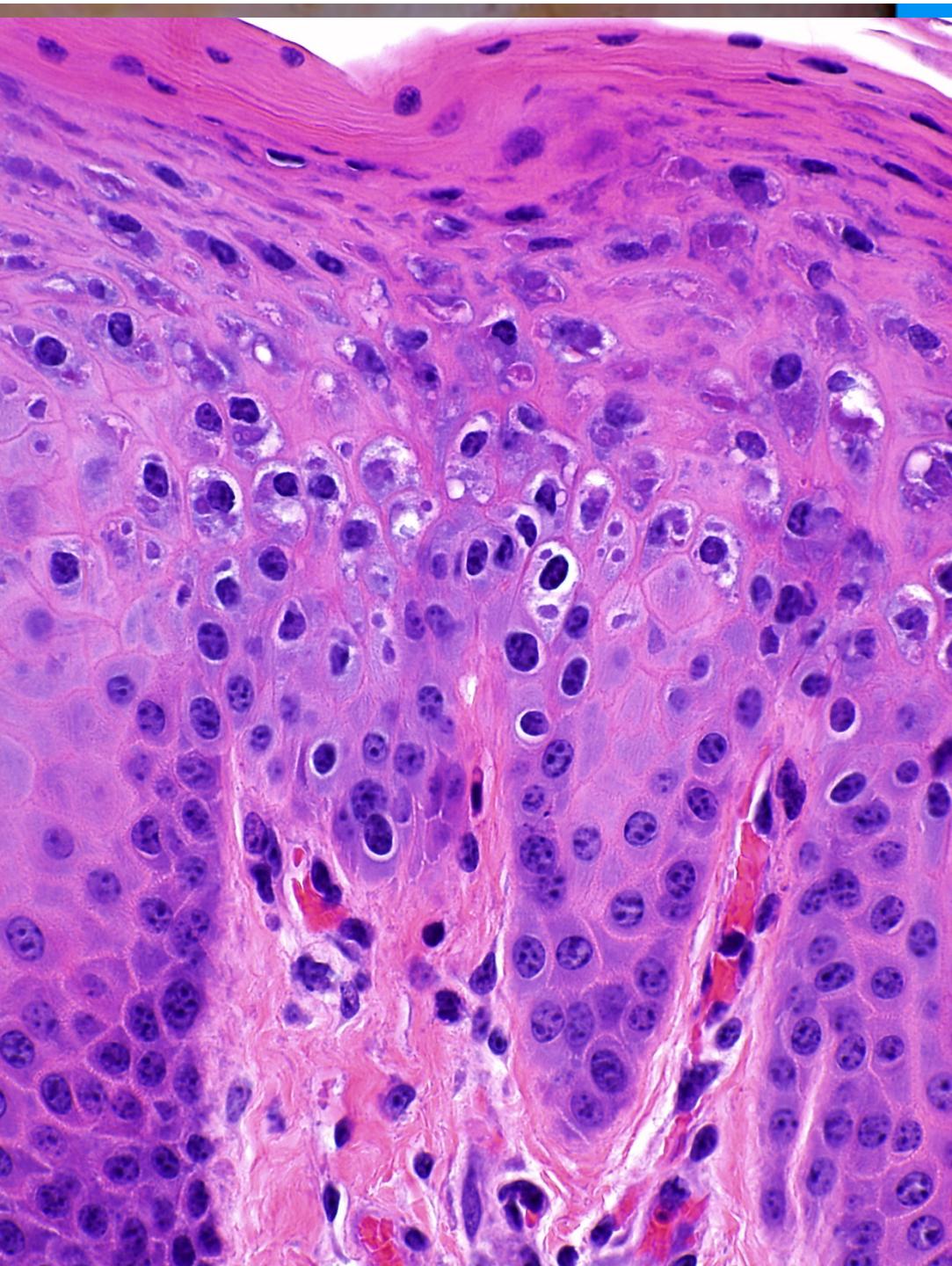
Francisco A. Uzal

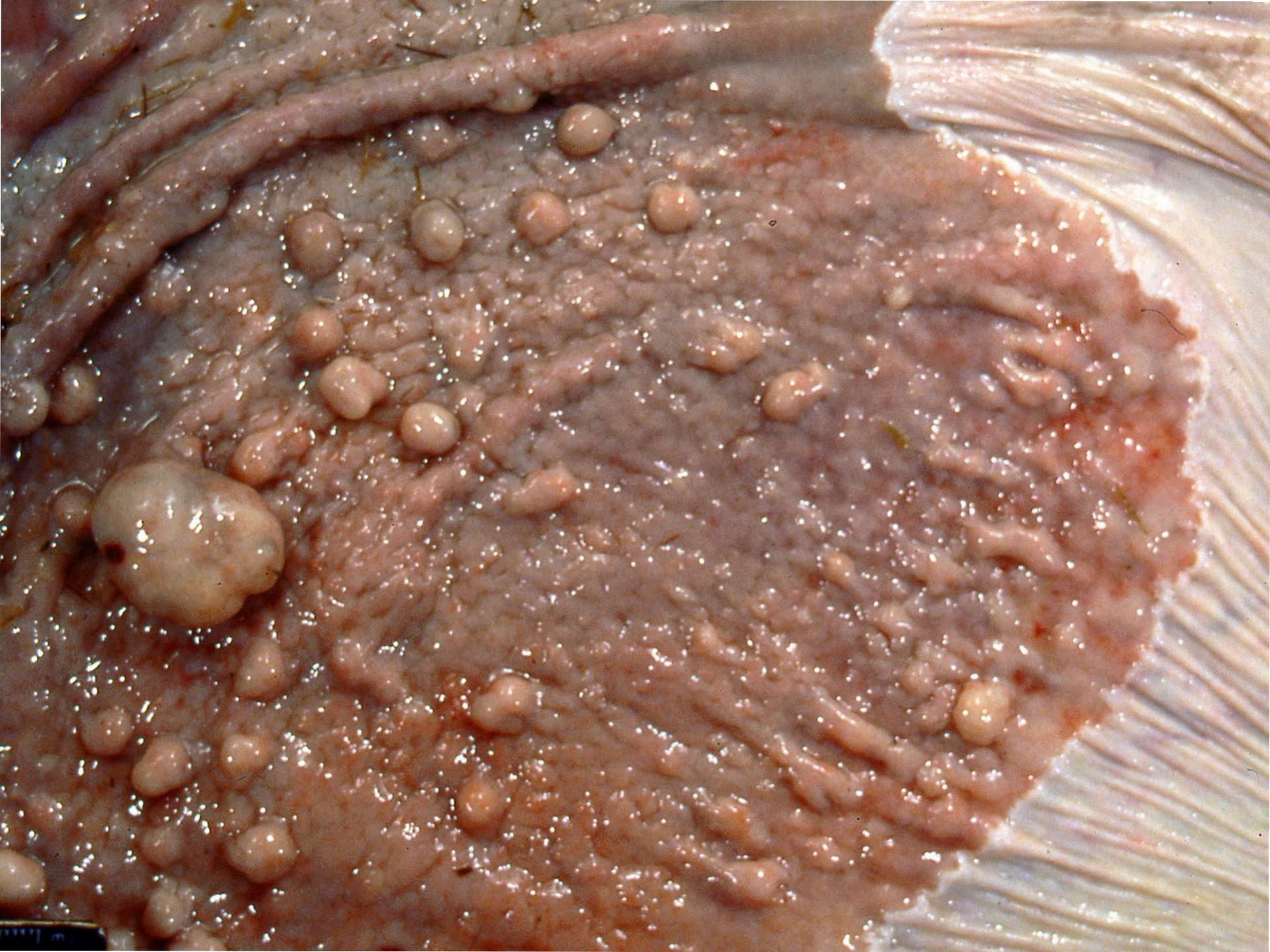
California Animal Health and Food Safety Laboratory System,
San Bernardino Branch, UC Davis



Upper alimentary tract













8mm

1mm

Equine enteritis–colitis

1-Infectious

2-Non-infectious

Equine enteritis–colitis

1-Infectious

2-Non-infectious

Bacterial

Clostridium spp.

Salmonella spp.

Rhodococcus equi

Ehrlichia ristiacci

Lawsonia intracellularis

Others

Parasitic

Strongylus spp.

Parascaris equorum

Others

Viral

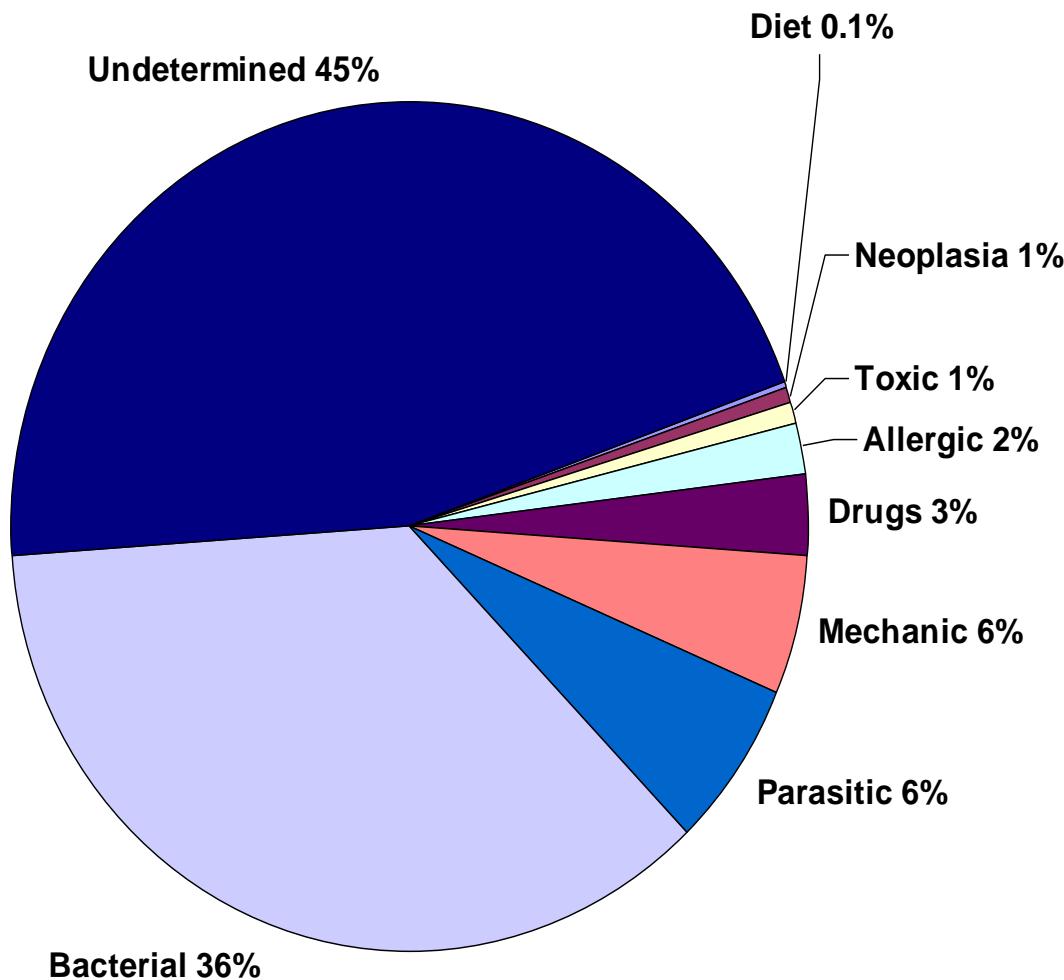
Rotavirus

Coronavirus

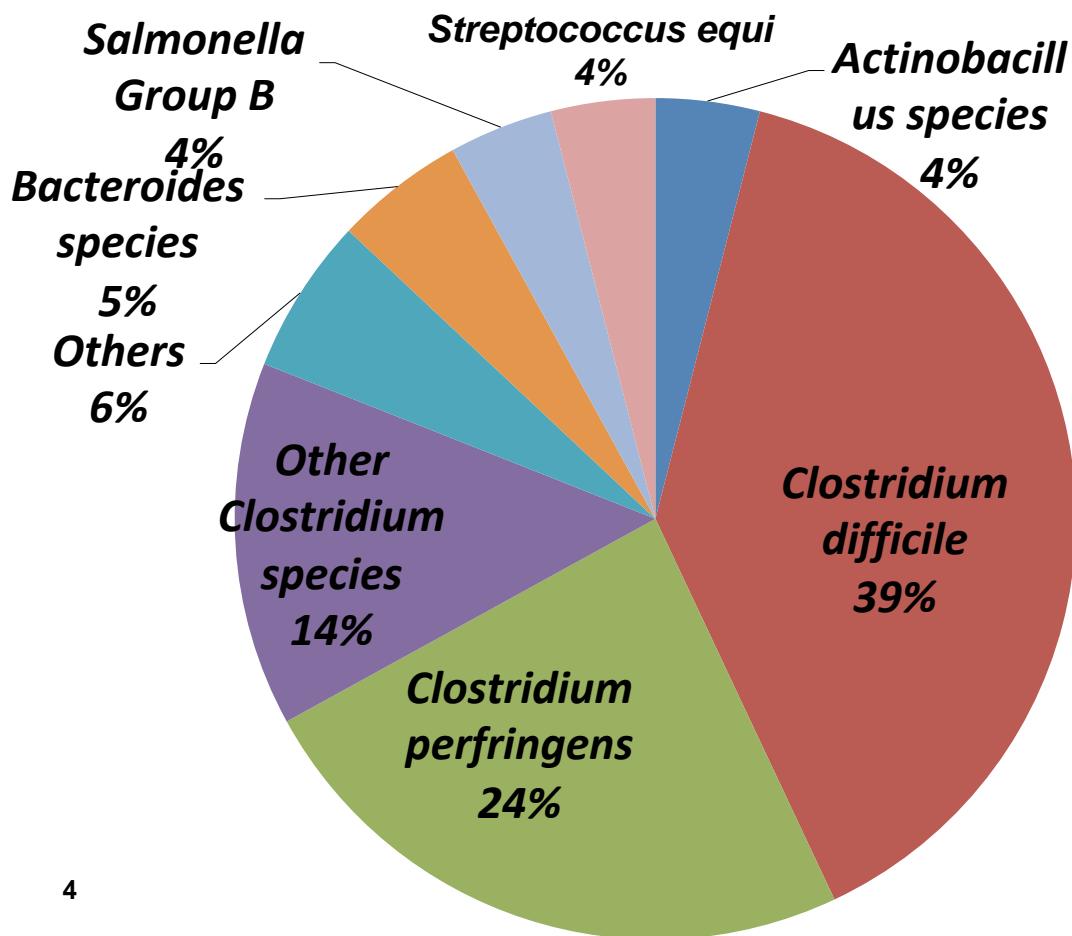
Fungal

Various

Intestinal disease: CAHFS 1990-2016 (n= 750)



Bacterial causes (1990-2016)



Bacterial

Clostridium spp.

Salmonella spp.

Rhodococcus equi

Ehrlichia ristiacci

Lawsonia intracellularis

Others

Parasitic

Strongylus spp.

Parascaris equorum

Others

Viral

Rotavirus

Coronavirus

Fungal

Various

Confirmed diseases

1-*C. perfringens* type C: enterocolitis

2-*C. difficile*: enterocolitis

3-*C. piliforme*: colitis, hepatitis, myocarditis

Other less understood entities

1-Colitis X

2-*C. perfringens* type A NetF+

3-*C. perfringens* type A CPB2+/CPE+

4-*C. sordellii* and others

Confirmed diseases

1-*C. perfringens* type C: enterocolitis

2-*C. difficile*: enterocolitis

3-*C. piliforme*: colitis, hepatitis, myocarditis

Other less understood entities

1-Colitis X

2-*C. perfringens* type A NetF+

3-*C. perfringens* type A CPB2+/CPE+

4-*C. sordellii and others*

The 2018 *C. perfringens* toxin-based typing scheme

| Toxinotype | α -toxin (cpa) | β -toxin (cpb) | ϵ -toxin (etx) | ι -toxin (iap and ibp) | CPE (cpe) | NetB (netB) |
|------------|--------------------------|-------------------------|----------------------------|------------------------------------|--------------|----------------|
| A | + | - | - | - | - | - |
| B | + | + | + | - | - | - |
| C | + | + | - | - | +/- | - |
| D | + | - | + | - | +/- | - |
| E | + | - | - | + | +/- | - |
| F | + | - | - | - | + | - |
| G | + | - | - | - | - | + |

Beta toxin

- * pore forming
- * NECROTIZING
- * VERY sensitive to trypsin

Take-home message!!!!

Due to this.....

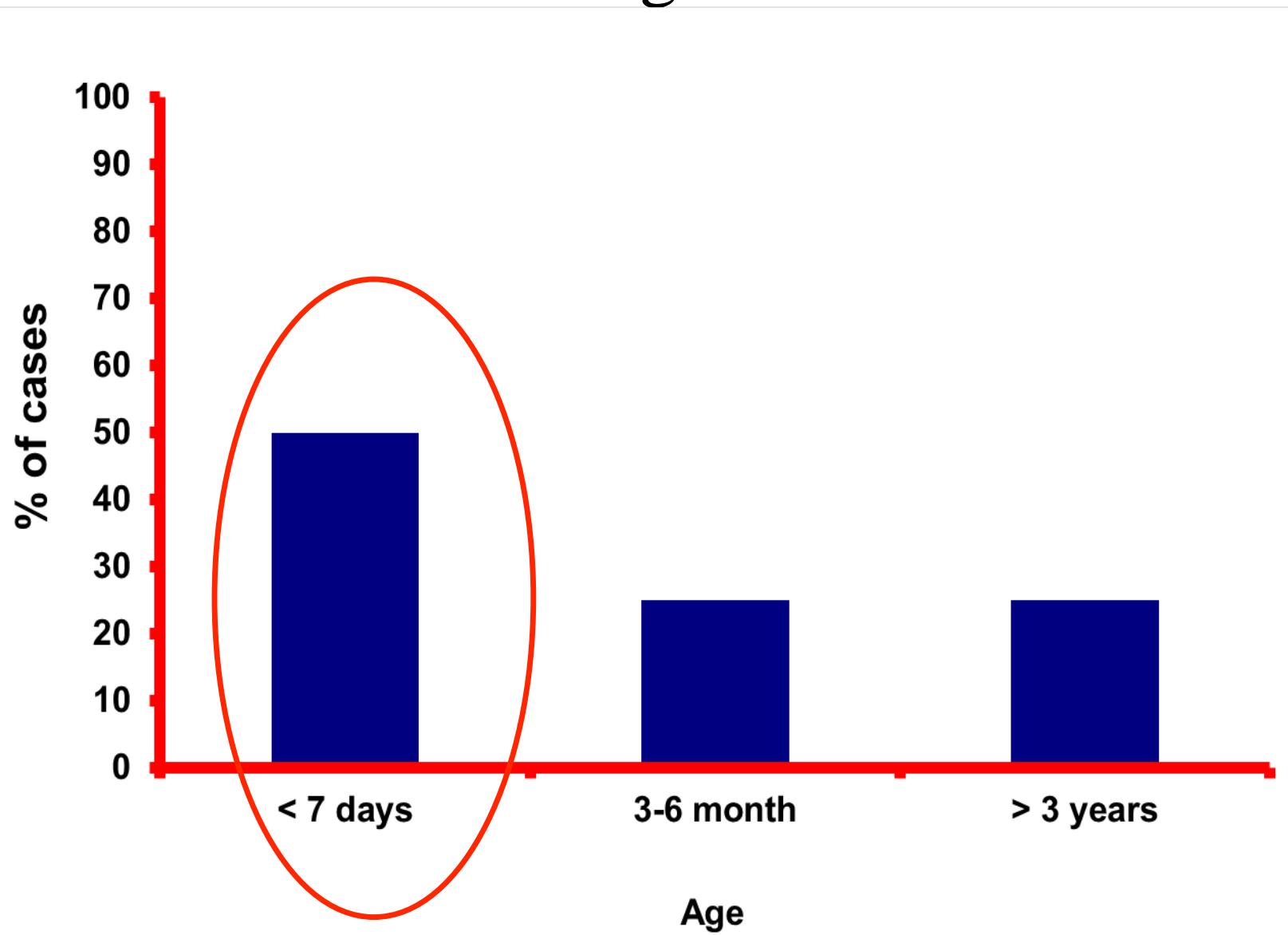
1-Intestinal trypsin: natural defense against
type C disease

2-Type C disease:

- neonates
- pancreatic disease
- trypsin inhibitors
(sweet potato; soybean)

CAHFS: 2003-2008 (n=20)

Age



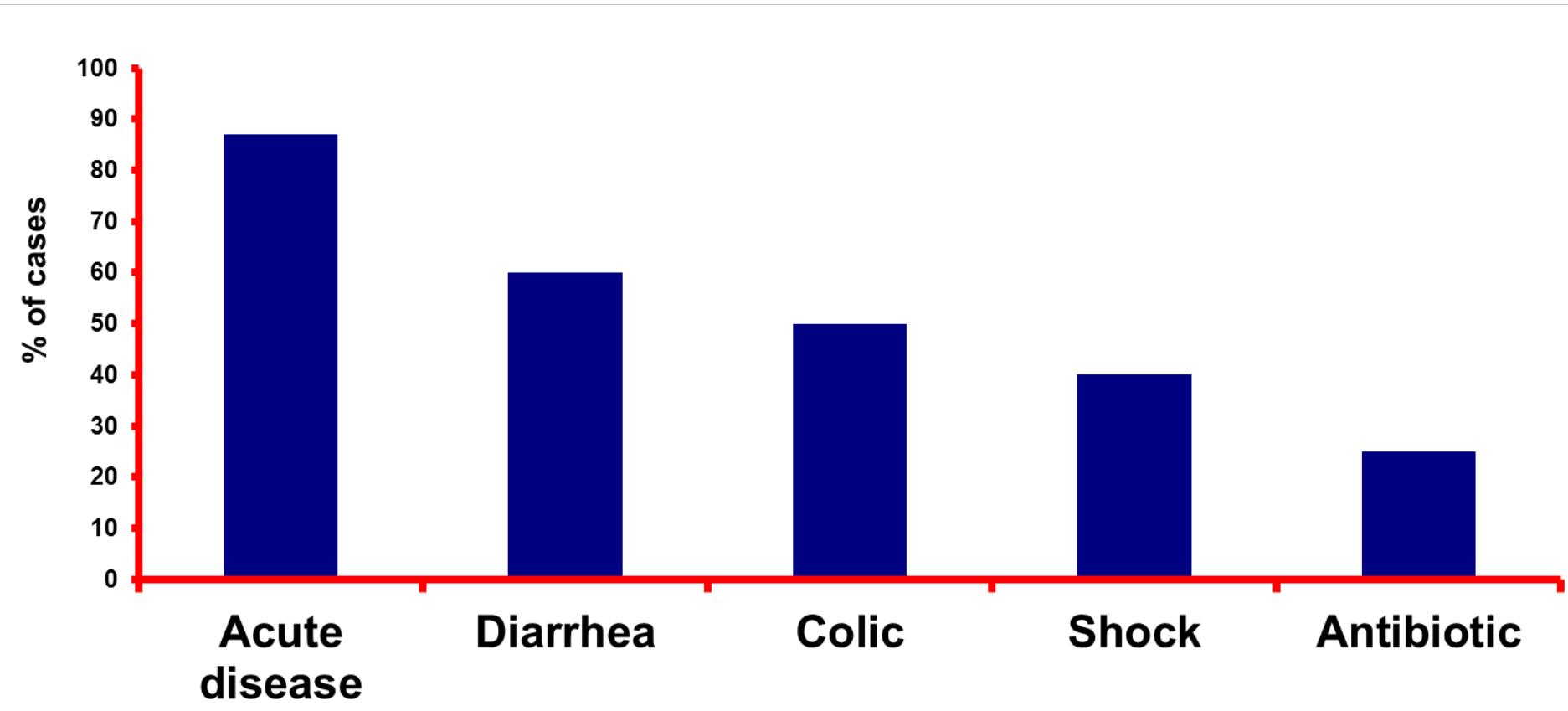
mainly foals

(cases in adults may occur)

MESSAGE TO REMEMBER

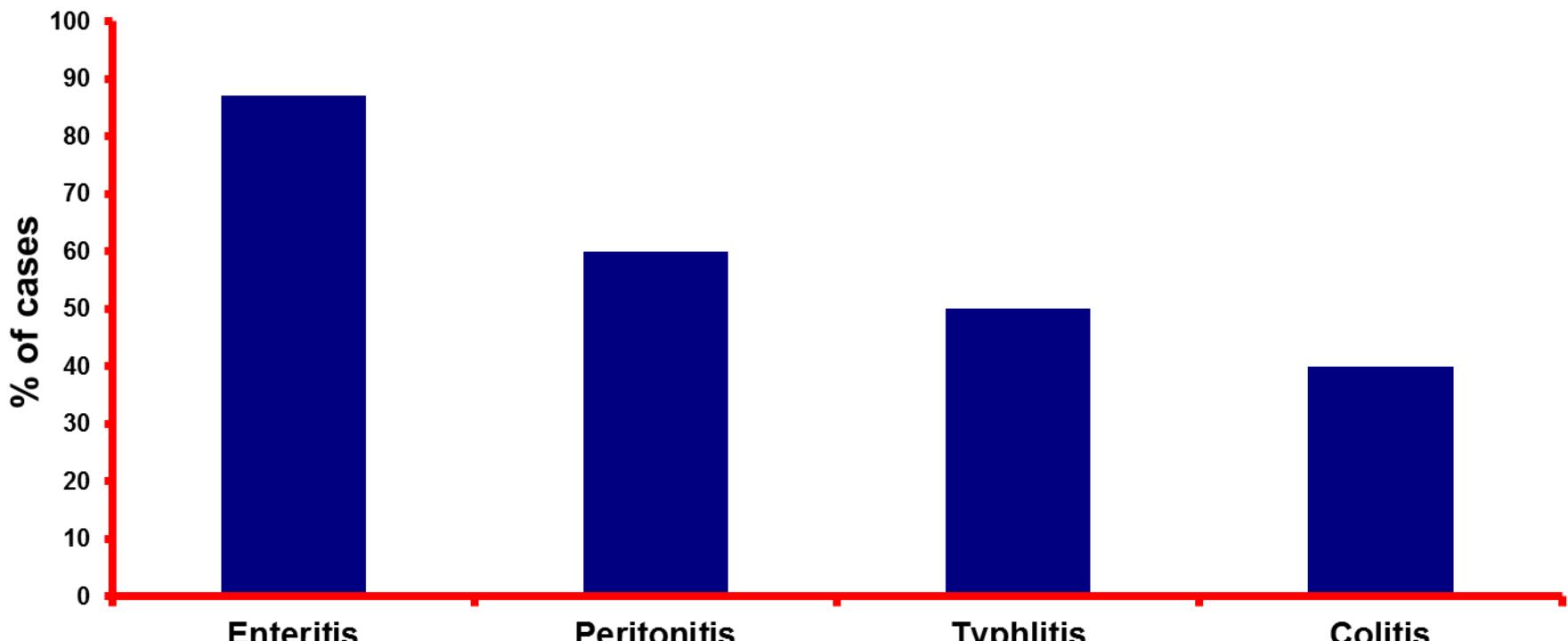
CAHFS: 2003-2008 (n=20)

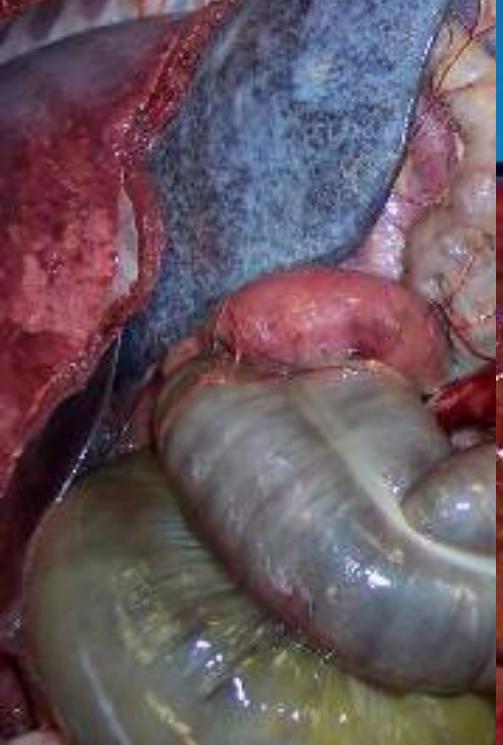
Clinical history

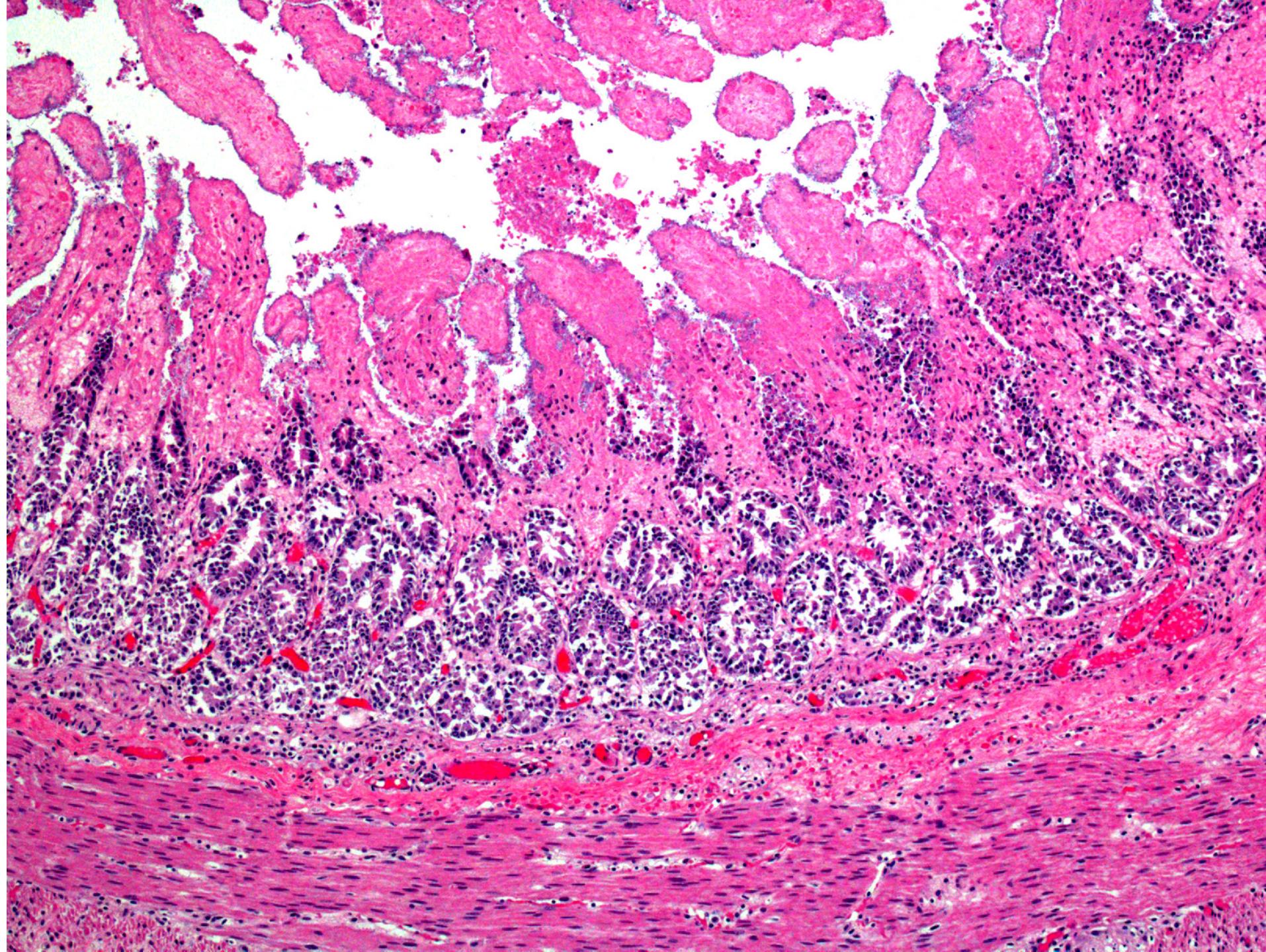


CAHFS: 2003-2008 (n=30)

Pathology of the GI tract

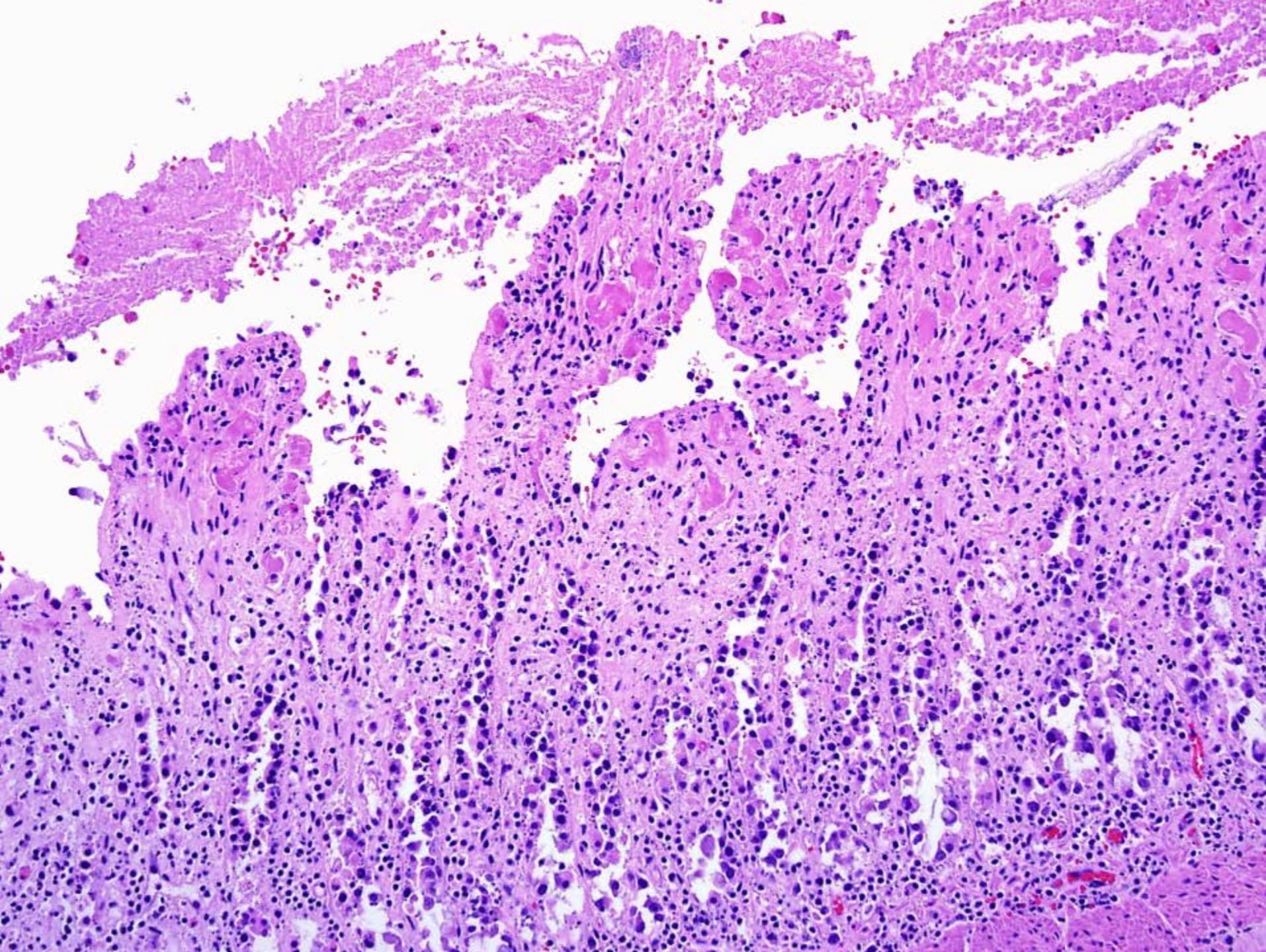






A high-magnification light micrograph showing a layer of pink-stained epithelial cells covering a underlying tissue. The nuclei of the cells are stained dark purple/blue. A few small, dark, rod-shaped structures are visible within the interstitium between the cells.

Value of seen rods on mucosa?



Diagnostic criteria

- | | | |
|-----------------|---|------------|
| 1-Clinics/gross | } | Suggestive |
| 2-Histology | } | Suggestive |

Diagnostic criteria

- 1-Clinics/gross } **Suggestive**
- 2-Histology } **Suggestive**
- 3-Culture (+ typing)/PCR } **Suggestive +**

Culture

- * Conventional anaerobic culture; PCR typing
- * Carrier rate: very low to nill

PCR

- * Alternative for culture (+ typing)
- * Does NOT replace toxin detection

Diagnostic criteria

- | | | |
|--------------------------|---|---------------------|
| 1-Clinics/gross | } | Suggestive |
| 2-Histology | } | Suggestive |
| 3-Culture (+ typing)/PCR | } | Suggestive + |
| 4-CPB toxin detection | } | Confirmatory |

Toxin detection (CPB)

capture ELISA

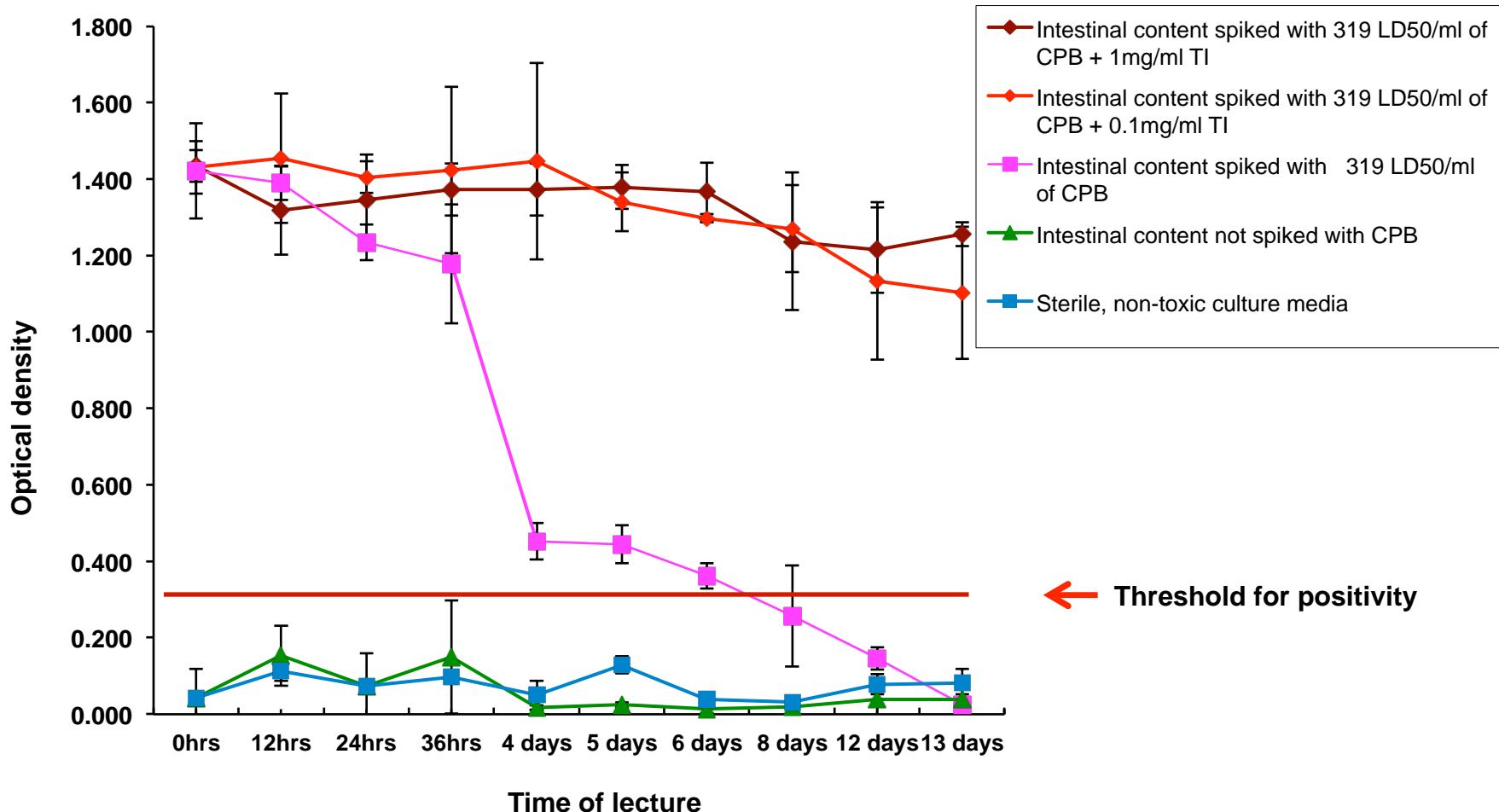
alpha toxin

beta toxin

epsilon toxin

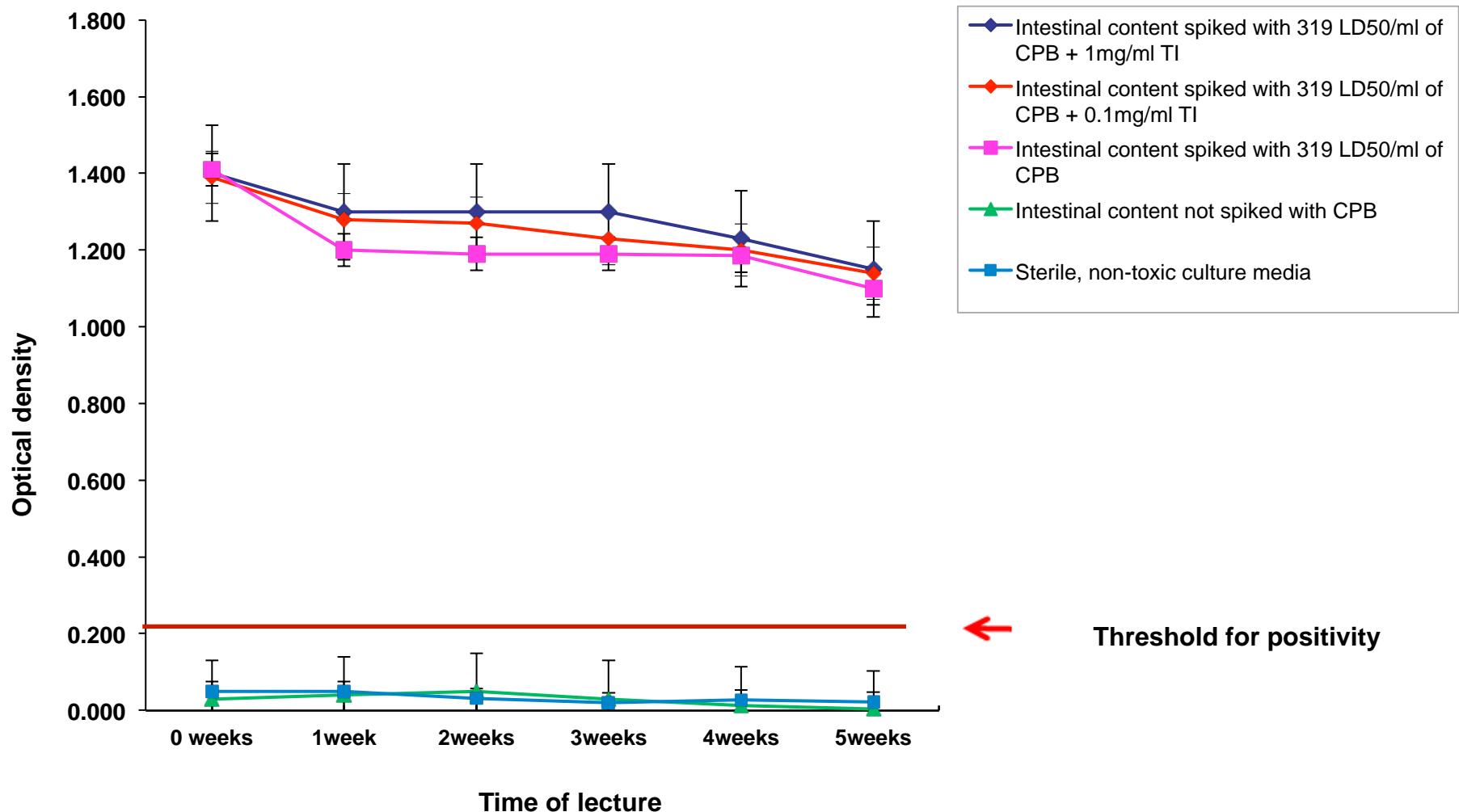
C. perfringens

CPB sensitivity to trypsin: 4°C



Macias Rioseco et el, 2015

CPB sensitivity to trypsin: -20°C



Macias Rioseco et al, 2015

C. difficile and *C. perfringens* type C co-infection
may occur

**FULL DIAGNOSTIC WORK UP
RECOMMENDED**

Differential diagnoses

- C. difficile*
- Salmonella* spp.
- NSAIDs

Others?????

a few examples.....

Foal: hemorrhagic diarrhea;
necrotic enterocolitis

ELISA toxins of *C. perfringens*

Alpha +

Beta -

Epsilon -

C. perfringens +

Isolation of C. perfringens type A

Non diagnostic

Foal: hemorrhagic diarrhea;
necrotic enterocolitis

ELISA toxins of *C. perfringens*

| | |
|-----------------------|---|
| Alpha | + |
| Beta | + |
| Epsilon | - |
| <i>C. perfringens</i> | + |

Enterocolitis by *C. perfringens* type C

Foal: hemorrhagic diarrhea;
necrotic enterocolitis

ELISA toxins of *C. perfringens*

| | |
|-----------------------|---|
| Alpha | + |
| Beta | - |
| Epsilon | - |
| <i>C. perfringens</i> | + |

Isolation of *C. perfringens* type C

Suspicious: enterocolitis *C. perfringens* type C

Foal: hemorrhagic diarrhea;
necrotic enterocolitis

ELISA toxins of *C. perfringens*: not available

Isolation of *C. perfringens* type C

Suspicious +: enterocolitis *C. perfringens* type C

Foal: hemorrhagic diarrhea;
necrotic enterocolitis

ELISA toxins of C. perfringens

not available

No anaerobic culture

Etiology: undetermined



Confirmed diseases

1-*C. perfringens* type C: enterocolitis

2-*C. difficile*: enterocolitis

3-*C. piliforme*: colitis and hepatitis

Other less understood entities

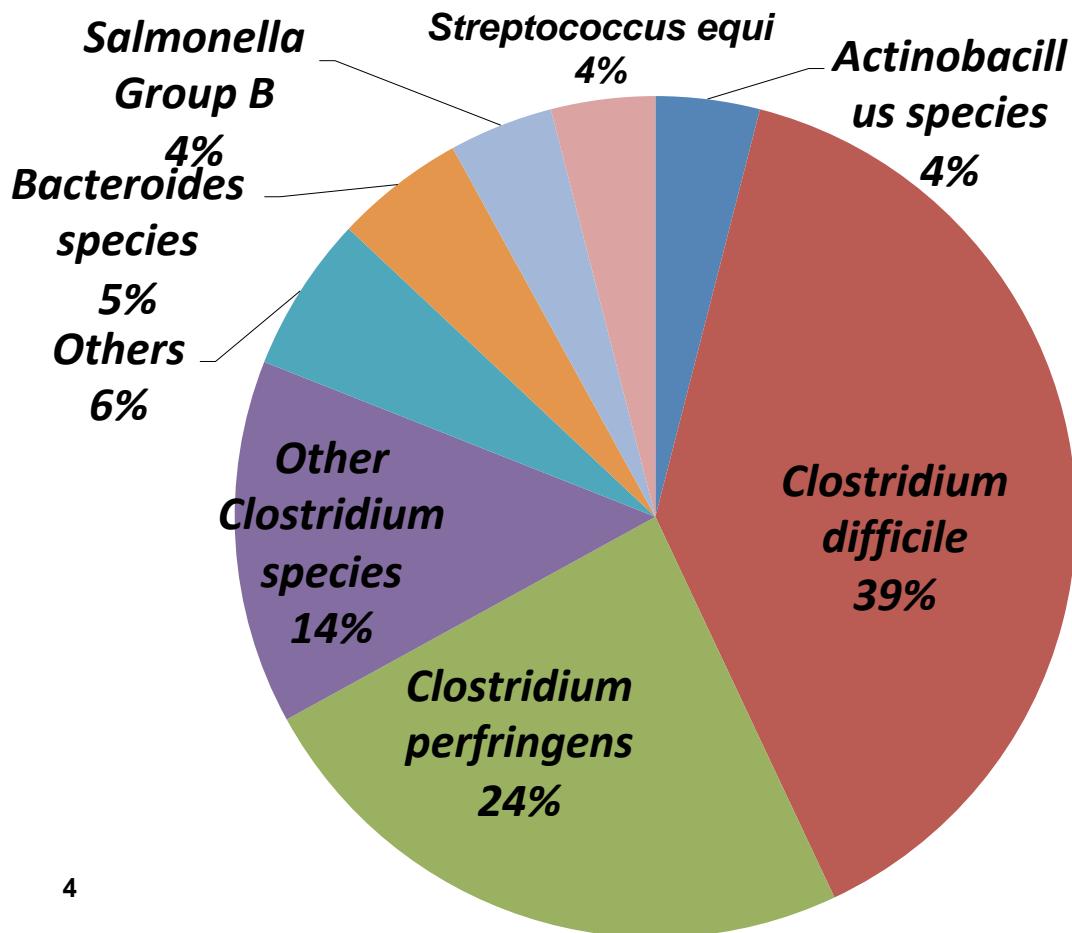
1-Colitis X

2-*C. perfringens* type A NetF+

3-*C. perfringens* type A CPB2+/CPE+

4-*C. sordellii*

Bacterial causes (1990-2016)



CAHFS database 2000-2016:

Enteric disease and:

1-*C. difficile* isolation

and/or

2-*C. difficile* toxins A/B detected

C. difficile infection cases studied

n=55

Culture (n=34)

+: 33

-: 1

Toxin (n=28)

+: 27

-: 1

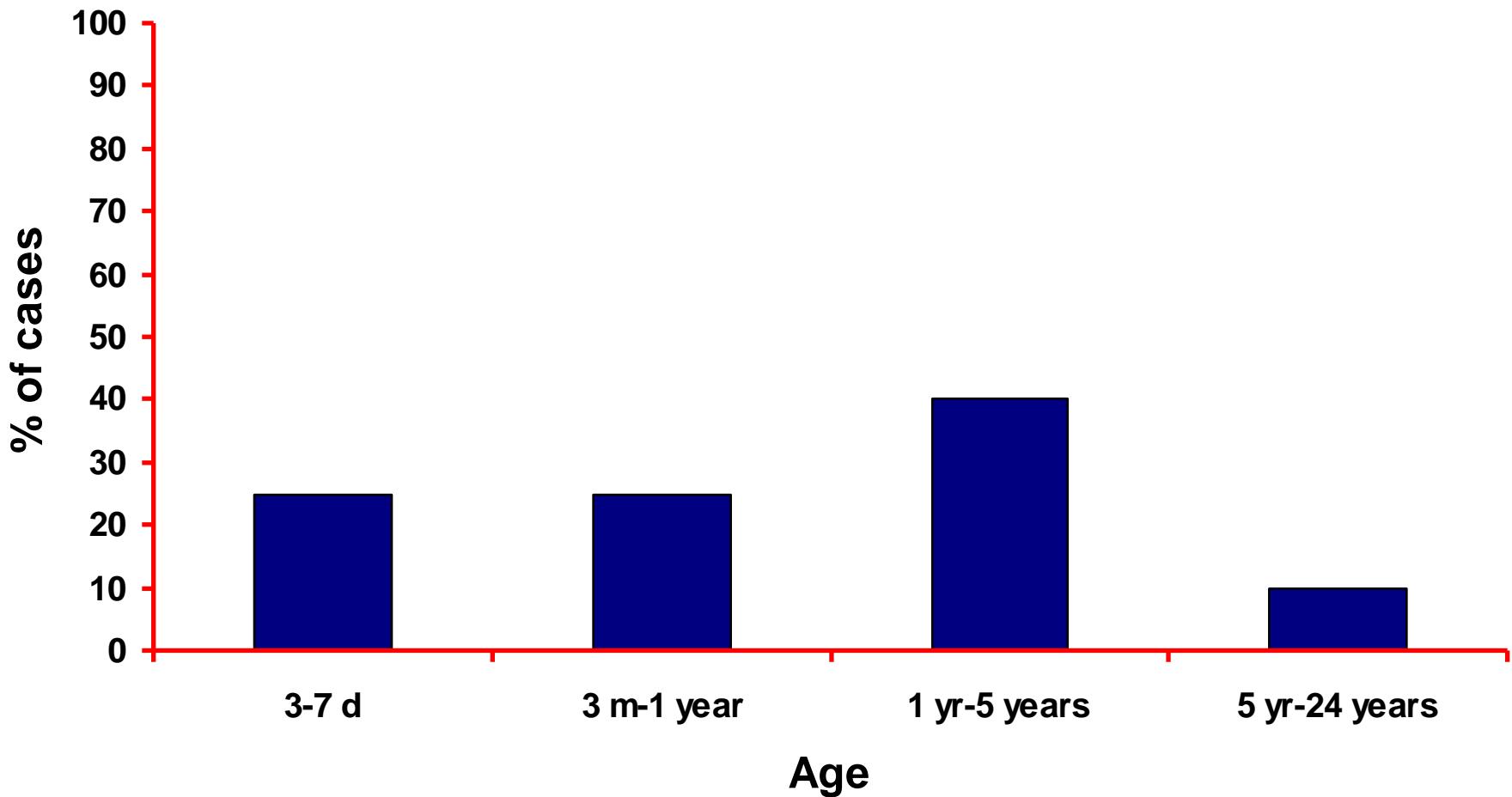
Controls:

40 horses with no enteric disease:
catastrophic leg injuries

(negative *C. difficile* culture and toxin
detection)

CAHFS: 2003-2016 (n=55)

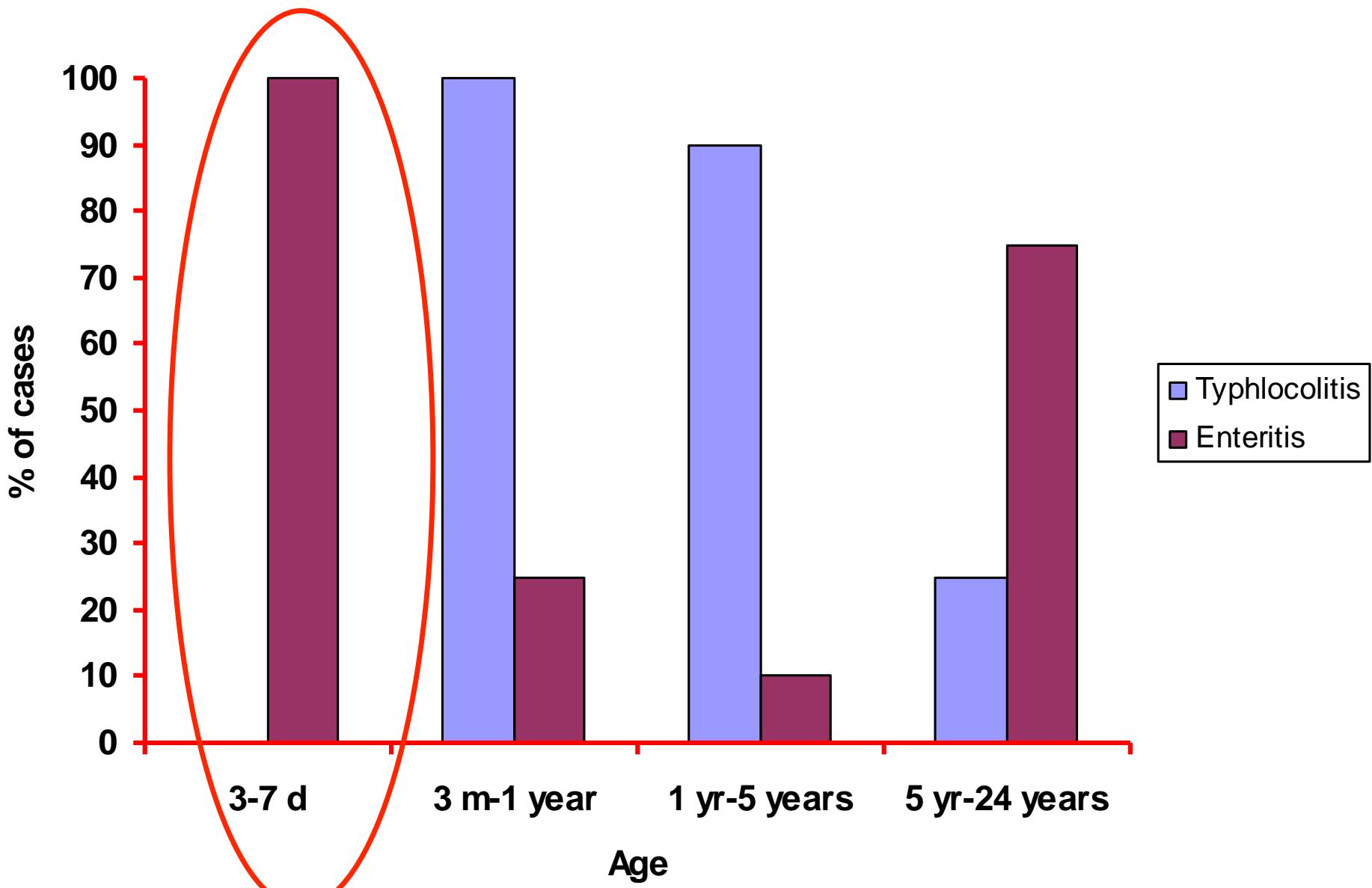
Age

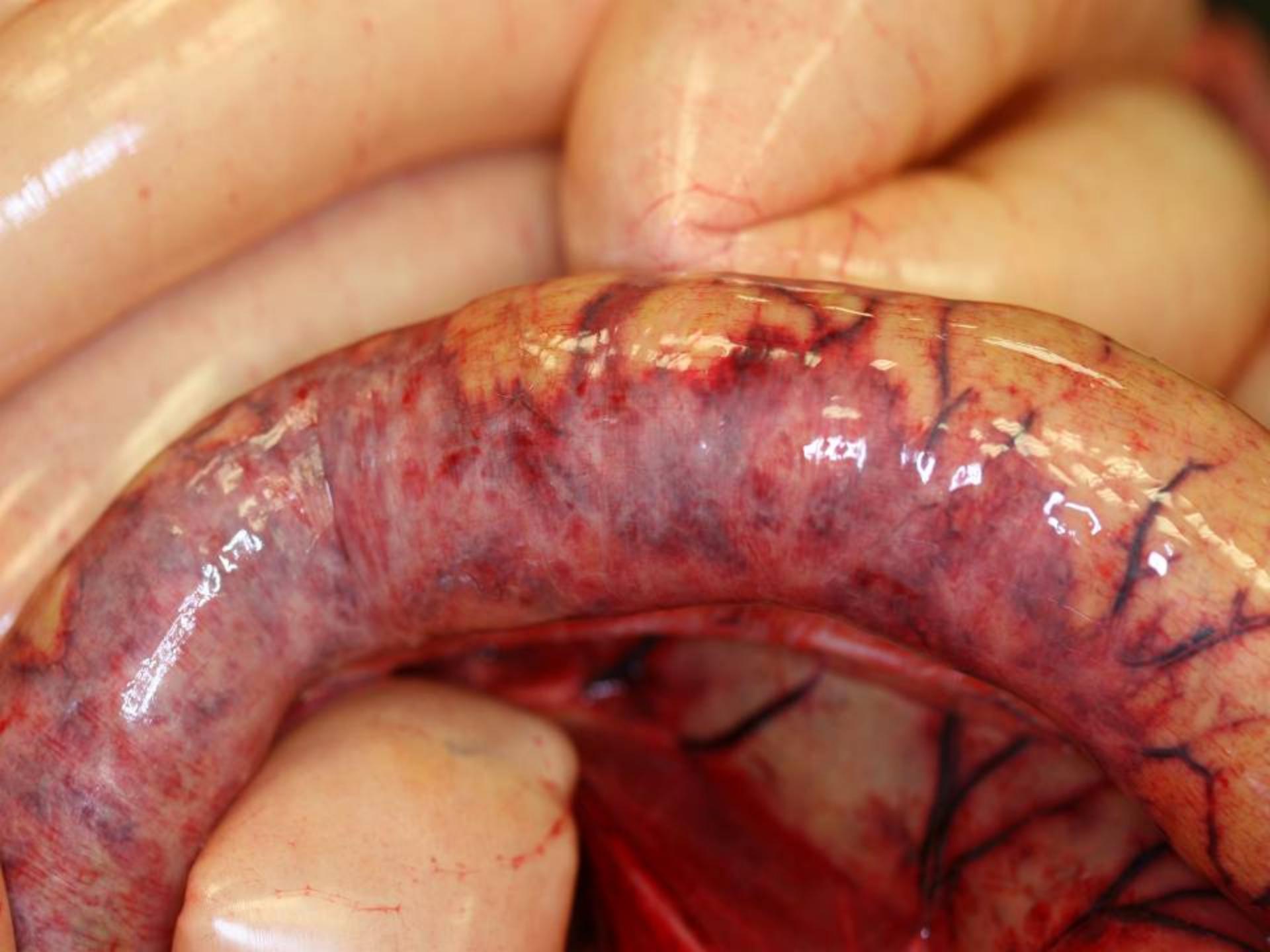


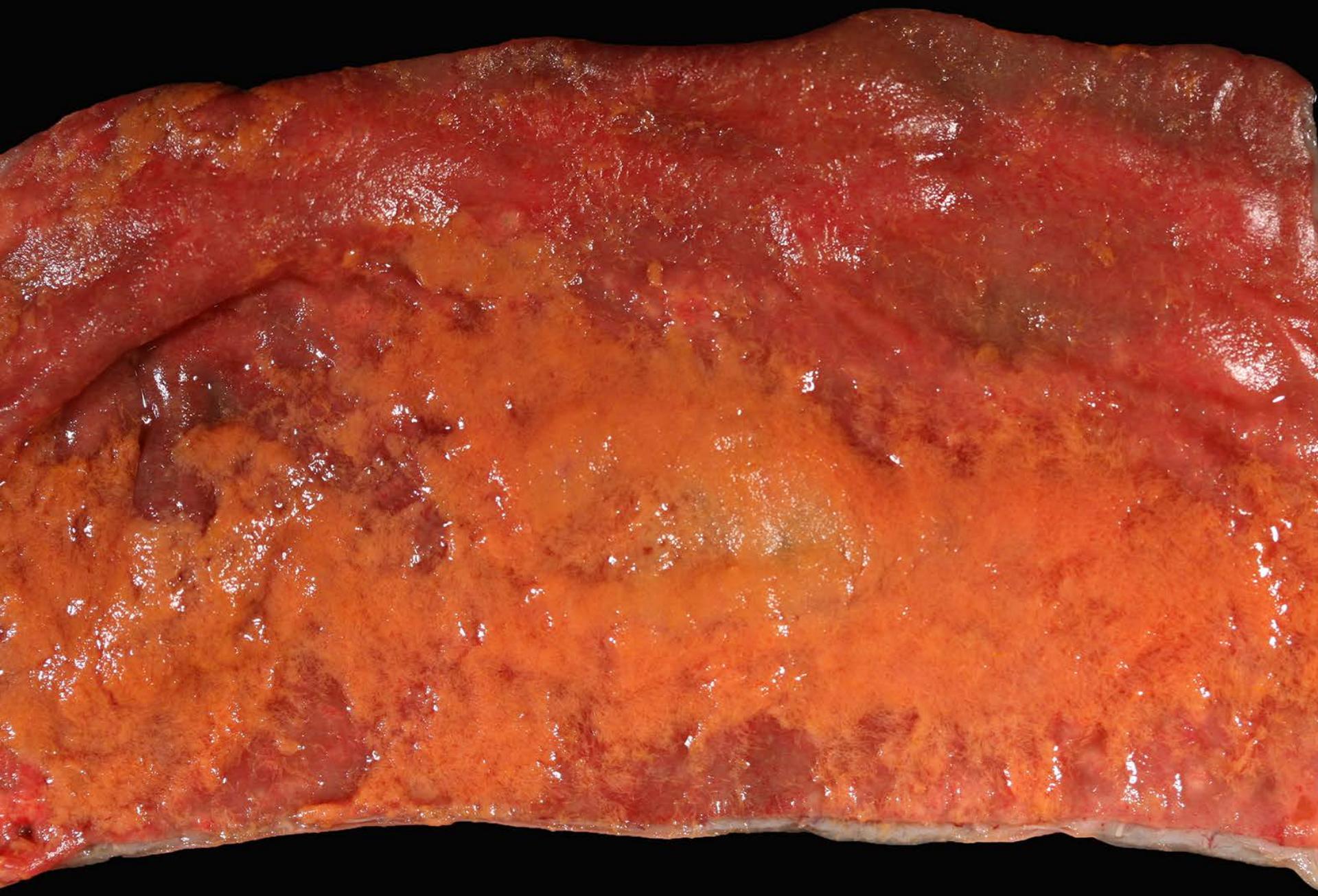
MESSAGE TO REMEMBER

Affects all ages

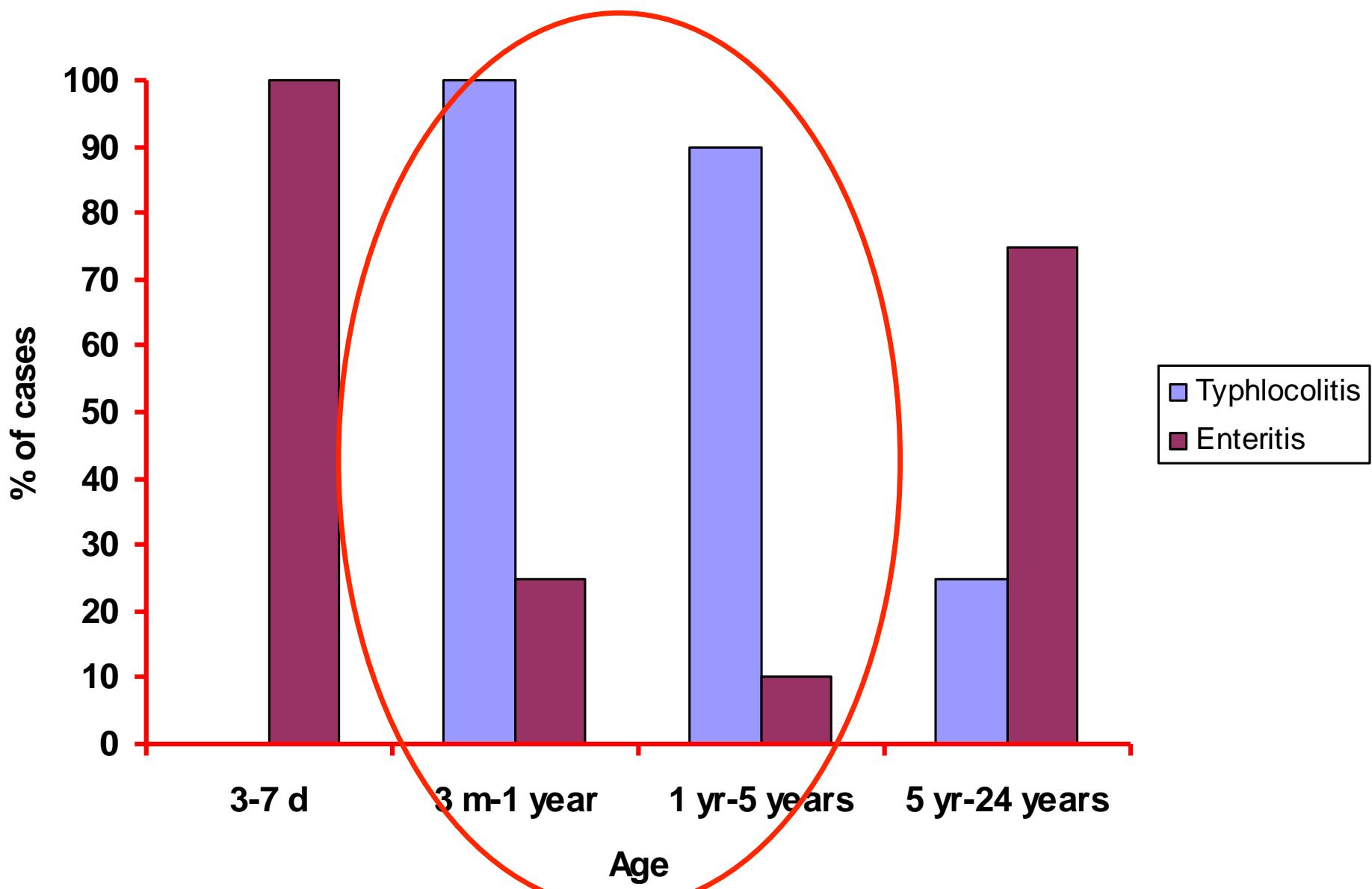
CAHFS: 2003-2016 (n=55)

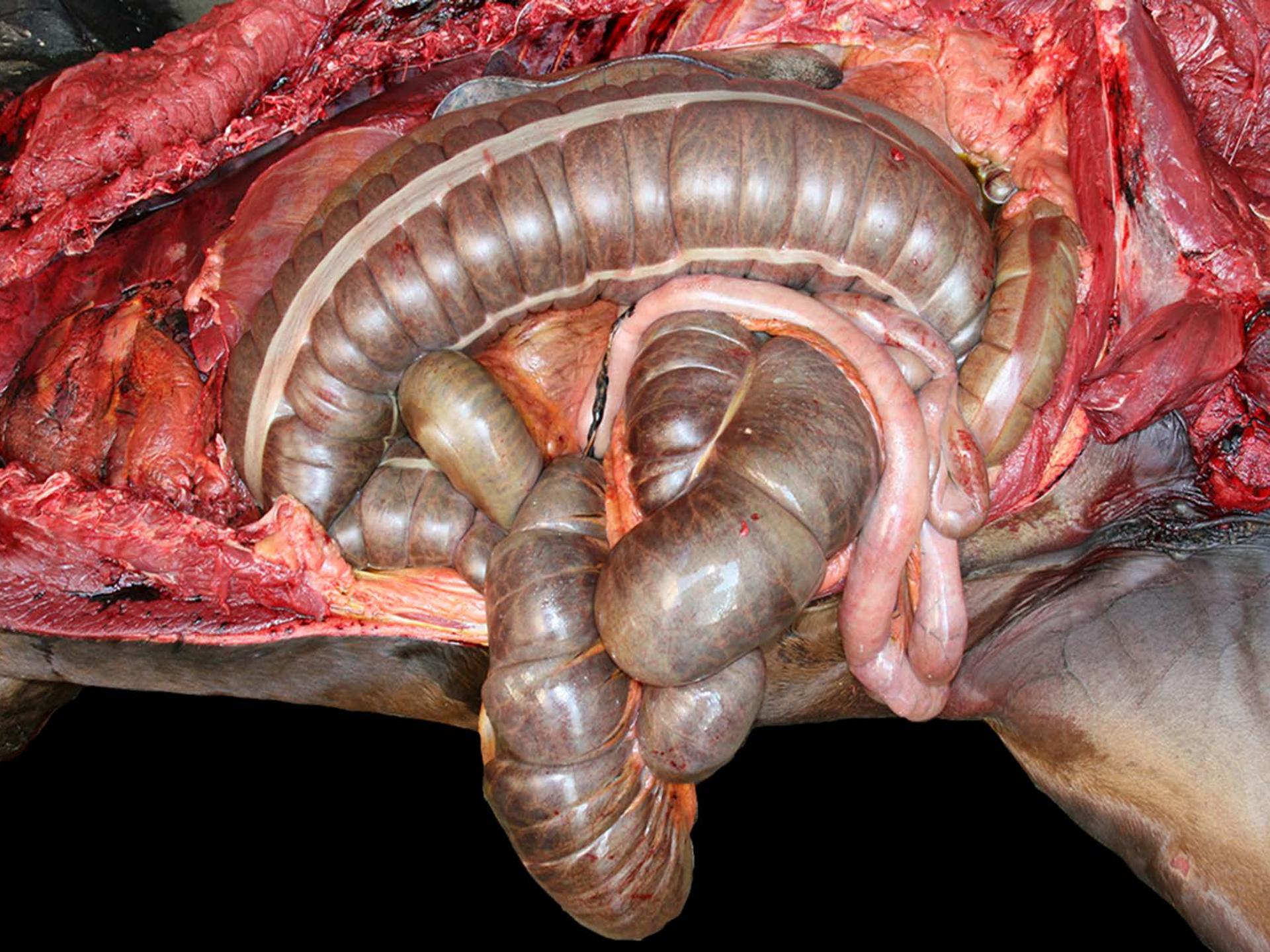






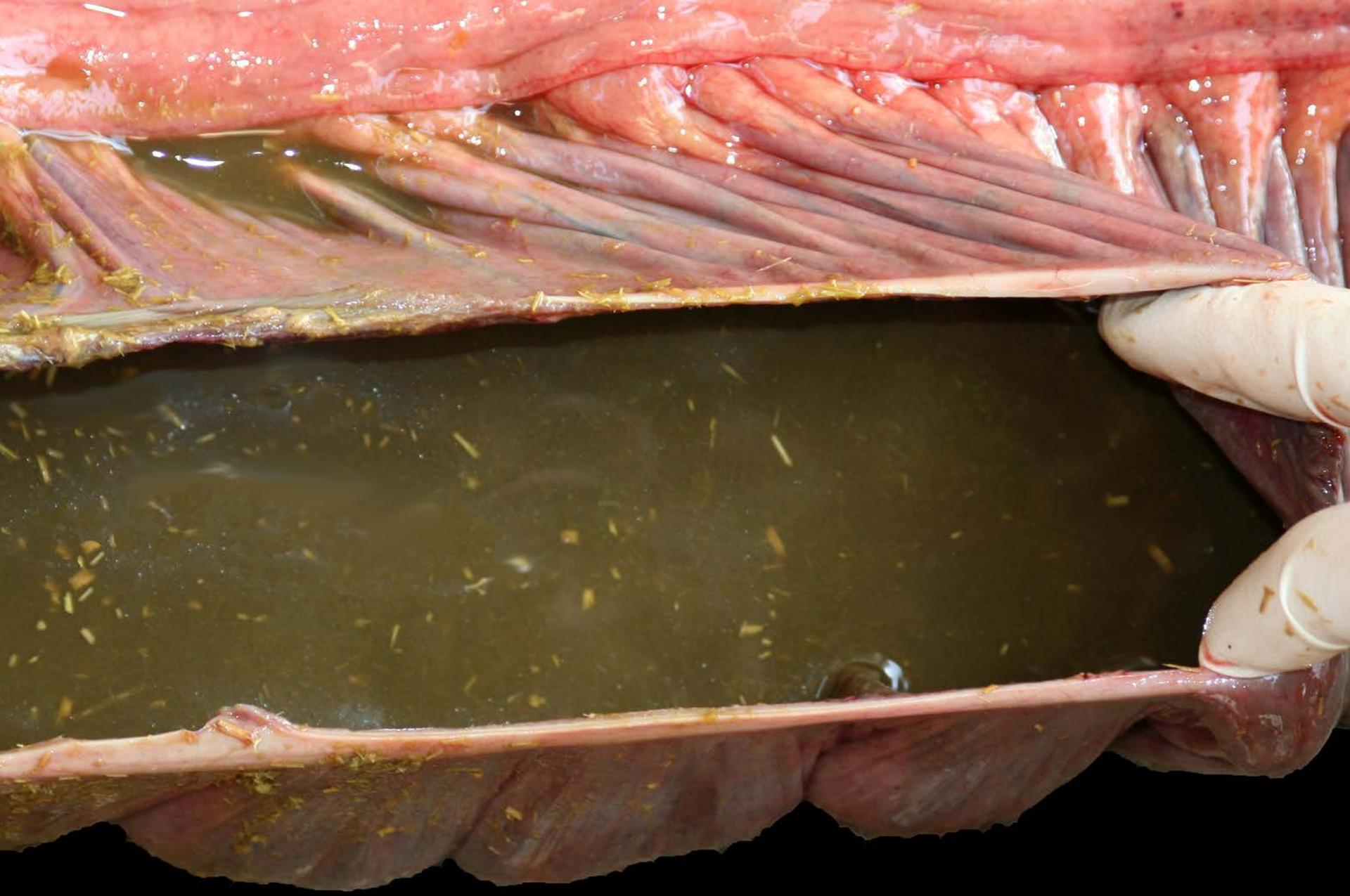
CAHFS: 2003-2016 (n=55)





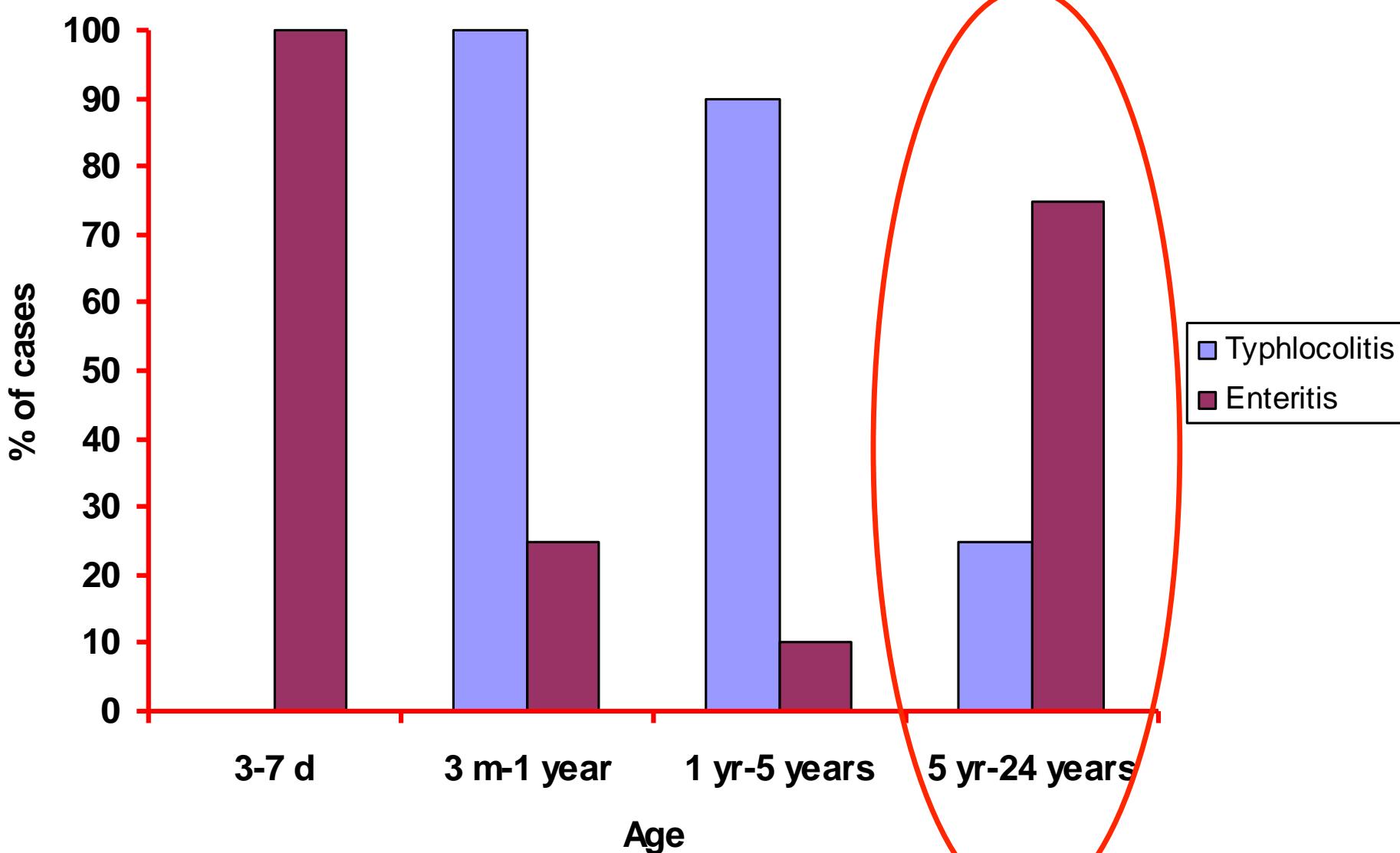








CAHFS: 2003-2016 (n=55)



Duod

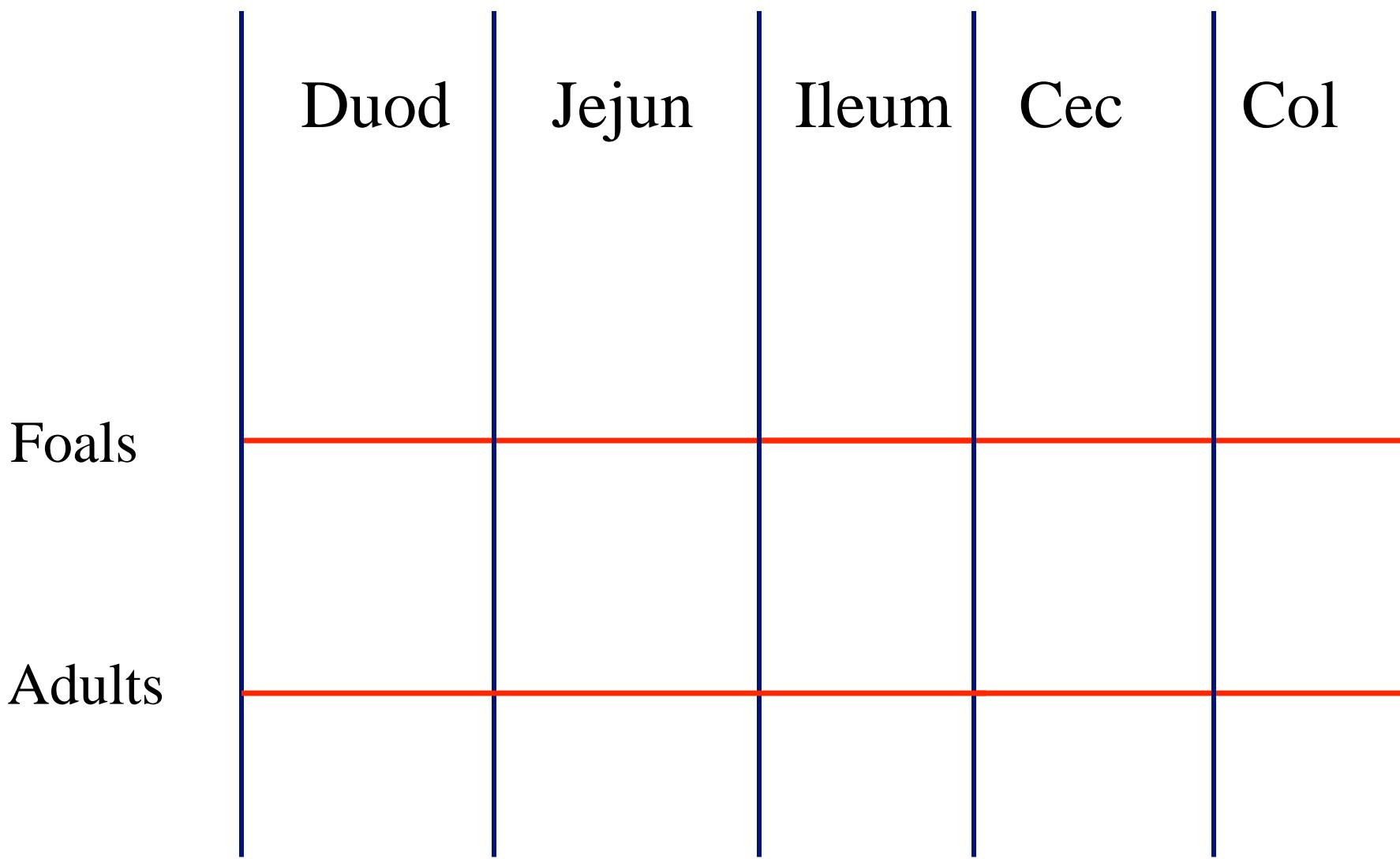
Jejun

Ileum

Cec

Col

Foals



Modified from Keel et al, 2008

CAHFS: 2003-2016 (n=55)

