

# Severity of antimicrobial-resistant non-typhoidal *Salmonella* infections treated in two large facilities of a health system in Pennsylvania, 2018-2020

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## Background

### Non-typhoidal *Salmonella* (NTS)

- Can cause severe infections involving the bloodstream and other normally sterile sites (1)
- Incidence of salmonellosis ~14.2/100,000 persons in the U.S. in 2021 (2)
- Burden of NTS each year in the US:
  - ~74,000 physician visits
  - ~19,000 hospitalizations
  - ~378 deaths
  - ~\$4.14 billion in direct and indirect costs (3)
- Drug-resistant and invasive NTS infections**
  - ~212,500 infections occur in the U.S. each year (4)
  - Antibiotics include ceftriaxone, ciprofloxacin, and amoxicillin (5)
  - Characterization of clinical outcomes of salmonellosis including invasive NTS is limited
  - Invasive *Salmonella* infections affect the bloodstream, bone, joint, brain, or nervous system, or other internal organs.
- National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS)**
  - Pennsylvania (PA) collaborates with federal and academic partners to enhance surveillance for AMR in NTS and outcomes

## Methods

### Study design and isolates from patients

- Prospective testing of NTS isolates submitted to the PA Bureau of Labs during 2018-2020 in compliance with public health reporting requirements (6)
- Isolates confirmed and serotyped by standard methods (7) [Figure 1]

### Antimicrobial susceptibility testing

- Confirmed NTS isolates from patients tested by broth microdilution method (Sensititre®, Trek Diagnostics, Westlake, OH) at the CDC and the FDA NARMS labs, respectively
- Minimum inhibitory concentrations (MICs) for each of the 15 antimicrobial agents used by (NARMS) determined and interpreted according to Clinical and Laboratory Standards Institute (CLSI) guidelines and consensus surveillance breakpoints (8)
- Isolates resistant to ≥3 antimicrobial classes were considered multidrug-resistant (MDR)

### Match isolate-level data with electronic medical records

- A data use agreement between the affiliated hospitals and PA Department of Health
- Institutional Review Board (IRB) approval
- Abstraction form for standardized data collection
- Data entered in Redcap database
  - Data collected included
    - Demographics (e.g., sex, and age)
    - Past medical history (e.g., diabetes, and atherosclerosis)
    - Diagnoses including isolate source (i.e., stool, urine, blood or other)
    - Antibiotics treatment (Yes or No) and specific drugs used
    - Severity (e.g., emergency department visit, and intensive care admission)

## Methods (Continued)

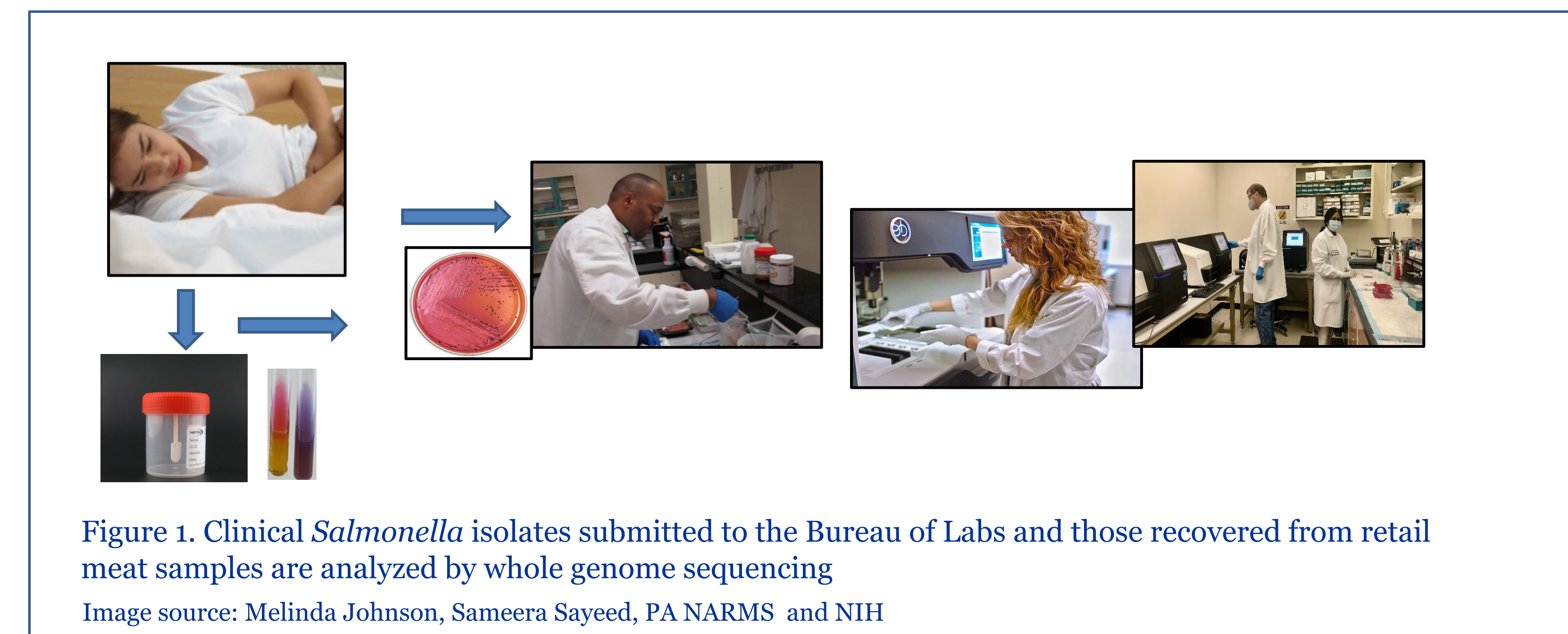


Figure 1. Clinical *Salmonella* isolates submitted to the Bureau of Labs and those recovered from retail meat samples are analyzed by whole genome sequencing  
Image source: Melinda Johnson, Sameera Sayeed, PA NARMS and NIH

## Results

### Antimicrobial resistance (Figure 2)

- Seven isolates (9%) were MDR
- Twelve (15%) had decreased susceptibility to ciprofloxacin (MIC ≥0.12 µg/mL)
- Three (4%) were ceftriaxone resistant (Figure 2)
- One (1%) demonstrated resistance to azithromycin

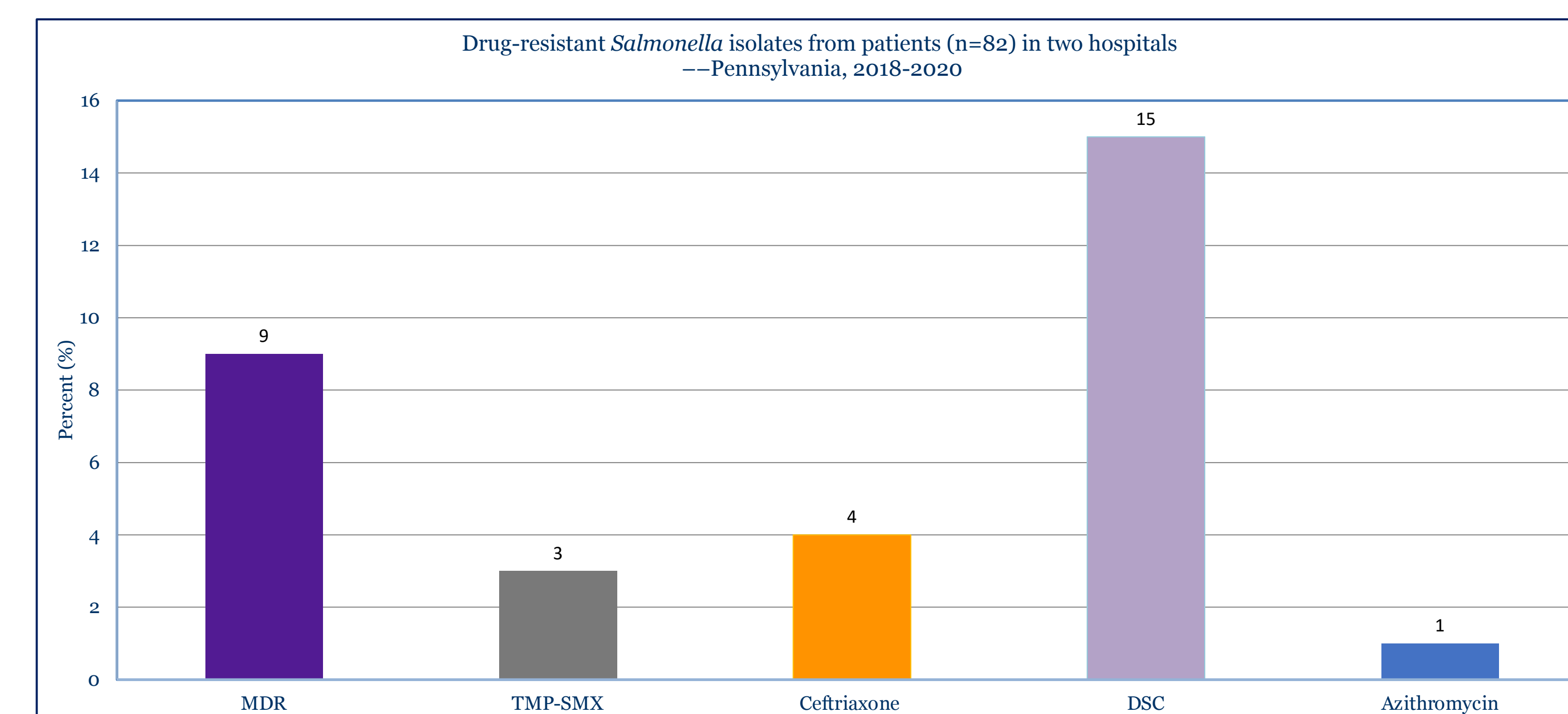


Figure 2. Figure 2. Percent of isolates from patients in two facilities associated with a health system in Pennsylvania, 2018–2020. Seven isolates (9%) were MDR (resistant to ≥ 3 Clinical and Laboratory Standards Institute antimicrobial classes tested by NARMS), three (4%) demonstrated resistance to trimethoprim-sulfamethoxazole (TMP-SMX) and the same number were resistant to ceftriaxone. Additionally, 12 isolates had decreased susceptibility to ciprofloxacin (DSC) [MIC ≥0.12 µg/mL]

### NTS Patients' clinical characteristics and severity of infection (Figure 3)

- Eighty-two patients were matched with isolates in BOL
- Fifty-seven (70%) patients were prescribed antibiotics
- 20 (24%) were immunocompromised; Ten (12%) patients had invasive infections
- Hospital admission: 38 (46%), includes five (6%) patients in intensive care (Figure 3)

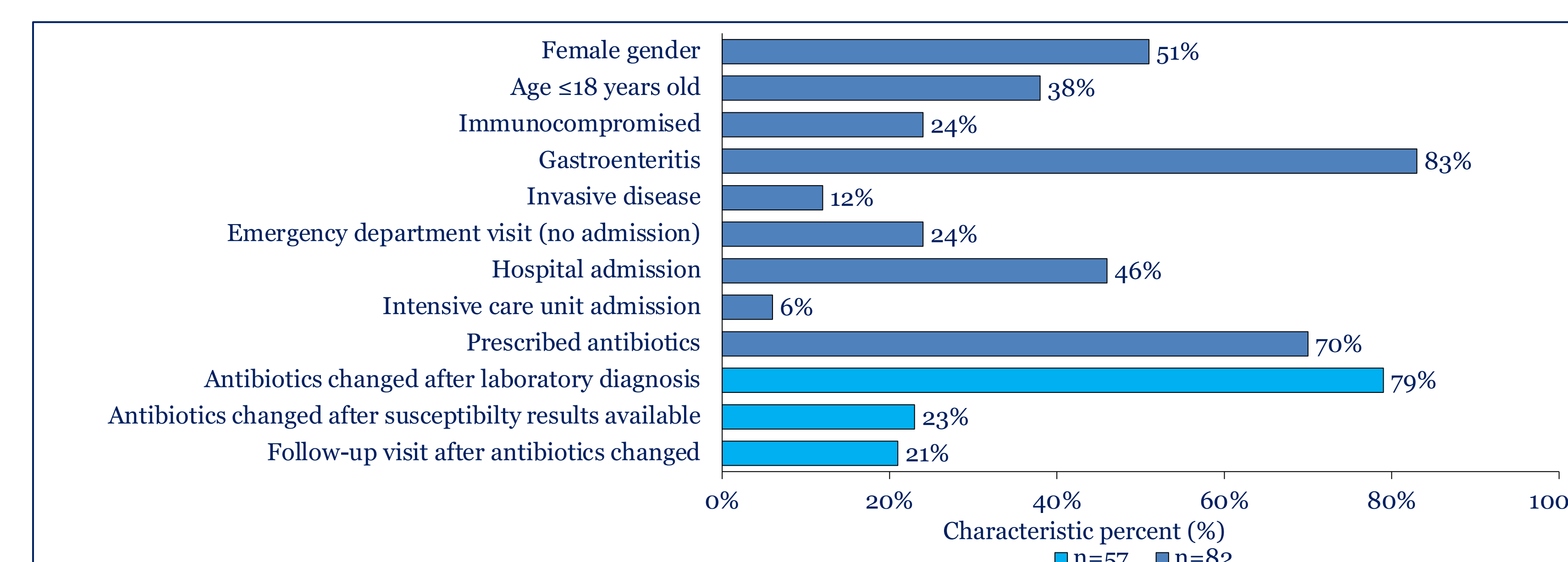


Figure 3. Demographic and clinical characteristics of patients with nontyphoidal *Salmonella* treated in two facilities associated with a health system in Pennsylvania, 2018–2020. The five patients treated in intensive care units are included in the total admissions (n=38). Salmonellosis was considered invasive if the organism was isolated from the blood or other normally sterile site (excluding urine).

## Conclusions

- Non-typhoidal *Salmonella* can cause severe invasive illness in some patients including immunocompromised individuals
- Drug-resistant NTS infections may be associated with more severity as compared with antimicrobial susceptible NTS (4)
- Electronic medical records can complement reportable data on *Salmonella* infections (9)
- Resistance to clinically consequential drugs coupled with the severity of infections suggests the need for antimicrobial stewardship
- Collaborations among public health, clinicians and academics can strengthen response antimicrobial resistance (10)

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All authors declare no conflict of interest

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