

# Multidirectional Transmission of *Clostridioides difficile* in Families with Young Infants



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## Background

- Community associated *Clostridioides difficile* infection (CA-CDI) afflicts older children and adults who do not have traditional risk factors (hospitalization, antecedent antibiotic exposure) for *C. difficile* colitis
- The identity of community reservoirs of the organisms associated with CA-CDI is uncertain
- Infants < 1 year of age asymptotically excrete toxigenic *C. difficile*, and diaper changes and bathing may present opportunities for transmission to their adult caregivers
- Observational studies suggest an association between CA-CDI and contact with a young infant

## Hypothesis

That infants colonized with *C. difficile* can transmit the organism to their parents

## Methods

- Families of healthy infants presenting to a suburban pediatric office for the baby's 4-month well child visit were recruited. All babies and mothers participated; fathers were encouraged but not required.
- Diapers containing stool were submitted every 2 weeks via USPS until the baby reached 8 months. Adults submitted rectal swab specimens using commercial diaper wipes at the same time.
- Stool and wipes were cultivated anaerobically on pre-reduced CDBA plates. Wipes additionally were cultured after a broth enrichment step. *C. difficile* was identified based on colony morphology and confirmed by a latex agglutination test. Toxin production was assessed using a commercial PCR assay.
- A subset of *C. difficile* isolated from > 1 family member were tested for relatedness by PCR-ribotyping and by whole-genome sequencing (WGS), using techniques and conditions previously described (ICHE 2021;42;731-6).
- Direction of transmission was inferred based on timing of the index isolate relative to those cultivated from other family members.

## Results

**TABLE 1 FAMILY CHARACTERISTICS**

No. families submitting ≥ 1 sample	30
Families with father participating	21
Duration follow-up (median (range) weeks)	12 (2-16)
No. families with ≥ 1 member <i>C. diff</i> positive	27
No. families with ≥ 1 member positive for toxigenic strain	22

**TABLE 2 INTRA-FAMILY *C. difficile* DISTRIBUTION**

No. families with only 1 parent positive	0
No. of families with both parents positive, baby negative	1
No. of families with infant positive, parent(s) negative	2
No. families with infant positive, 1 parent positive	11 <sup>a</sup>
No. families with infant positive, both parents positive	13 <sup>a</sup>
Duration of parent excretion (median (range) weeks)	4 (0-16)
Duration of baby excretions (median (range) weeks)	6 (0-16)

<sup>a</sup> 9 families had only one parent participating

**TABLE 3 INTRA-FAMILY DIRECTION OF *C. difficile* TRANSMISSION**

No. families with baby → parent transmission	9
No. families with parent → baby transmission	6
No. families with parent → parent transmission (without positive baby)	1
No. families where direction of transmission was indeterminate (baby and parent(s) positive same submission)	11
No. families with baby and adult positive, with same ribotype <sup>a</sup>	11/13

<sup>a</sup> Not all samples were ribotyped

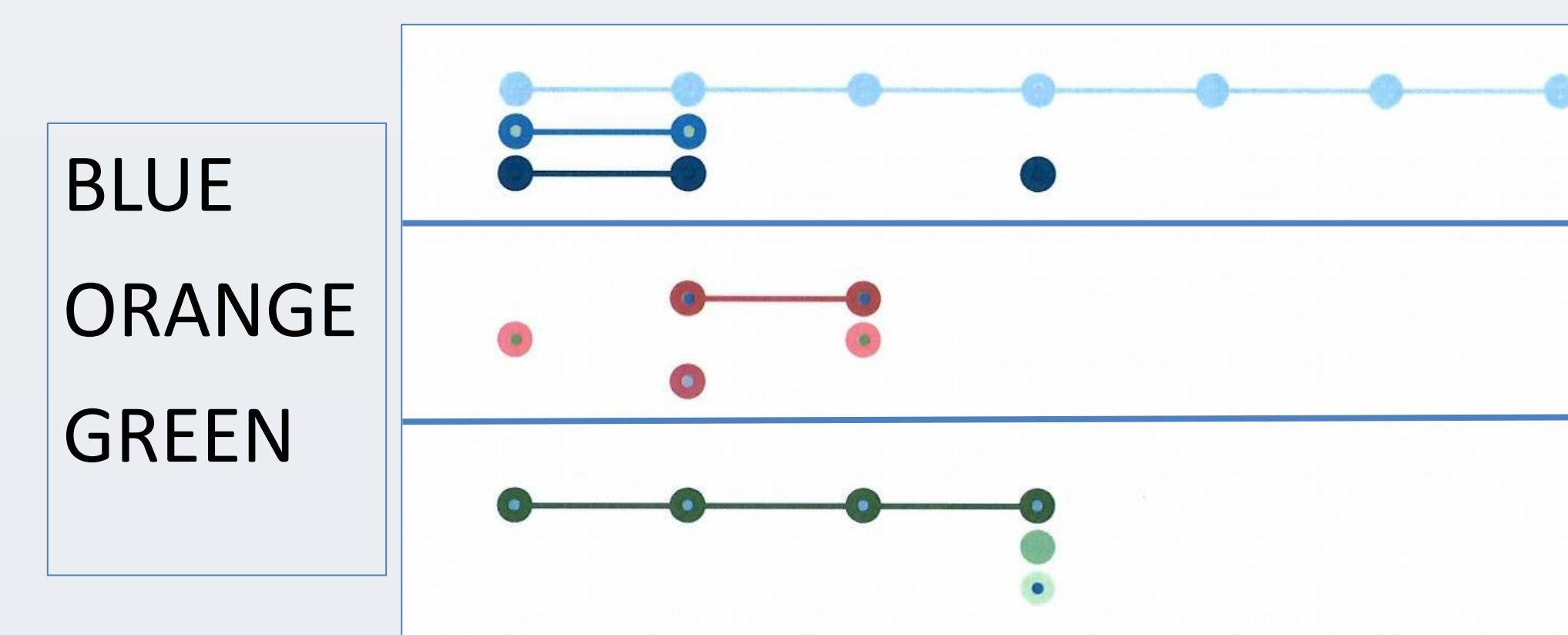


Figure 1. Representative families demonstrating different patterns of transmission. X-axis denotes study visit. Dots indicate specimen was positive on the specified visit. Each of three families are denoted by a color, with baby, mother, and father represented by top, middle, and bottom dots within each family, respectively. BLUE FAMILY: All positive simultaneously, transmission direction indeterminate. ORANGE FAMILY: Apparent transmission from mother to both child and father. GREEN FAMILY: Apparent transmission from baby to both parents.

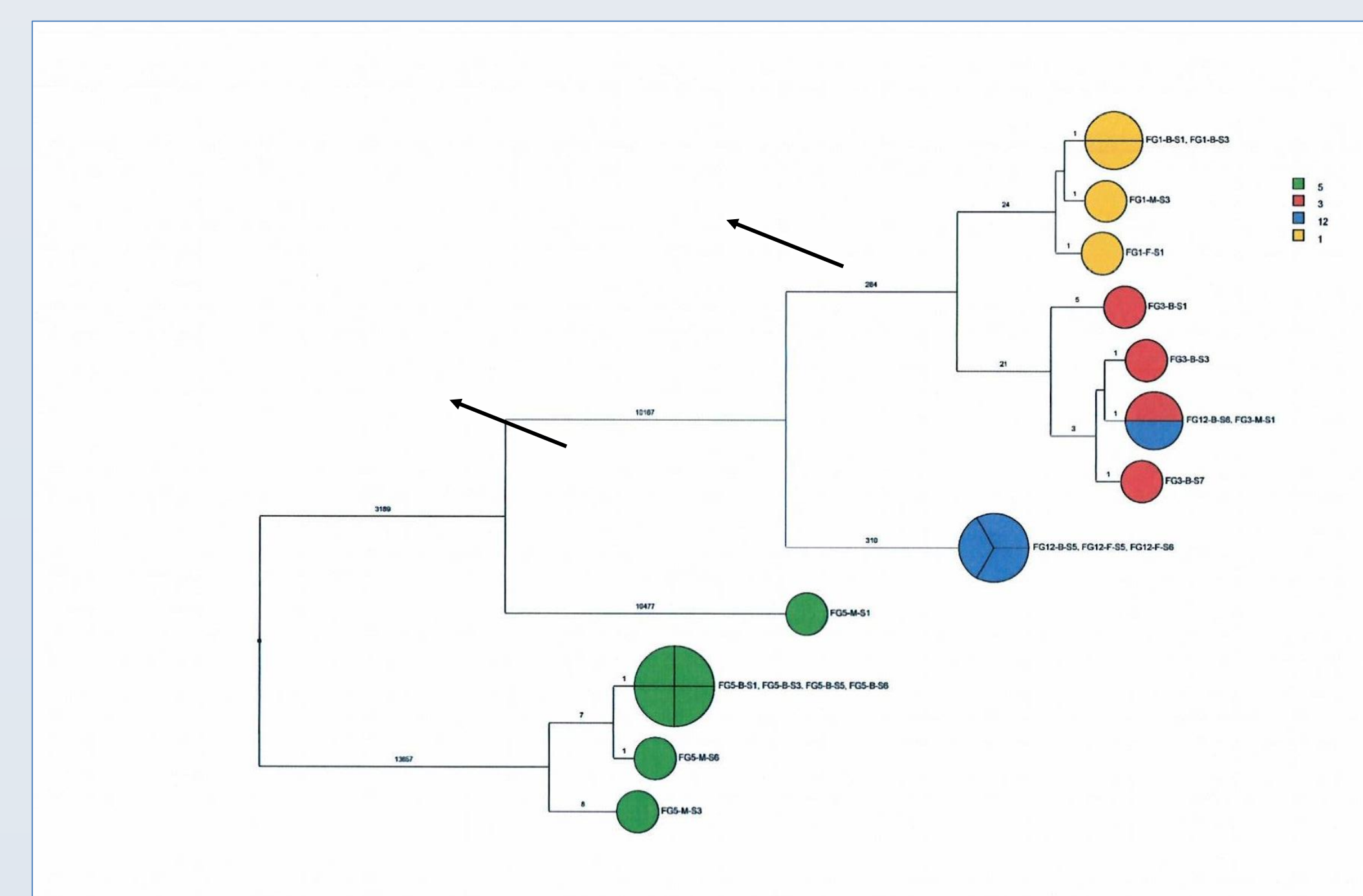


Figure 2. WGS dendrogram of isolates from baby and parents of 4 representative families, each distinguished by color. All intra-family isolates are highly related, except for an outlier second isolate from the baby in Blue Family, which was strongly related to isolates from Red Family; and an outlier second isolate from the mother in Green Family (both denoted by arrows).

## Conclusions

- C. difficile* colonization is common among healthy household members caring for an infant.
- Longitudinal observation suggests that transmission is multidirectional, with the organism passed from baby to adult and from adult to baby.

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