

# BioFire® Joint Infection Panel for samples other than synovial fluid

Nicola Benvenuto, Stefano Di Bella, Luigi Principe, Diego Luppino, Jacopo Conti, Venera Costantino, Manuela Di Santolo, Marina Busetti, Roberto Luzzati, Verena Zerbato\*

Nicola Benvenuto, Diego Luppino, Jacopo Conti, Verena Zerbato: Infectious Diseases Unit, Trieste University Hospital (ASUGI), Trieste, Italy

Stefano Di Bella, Roberto Luzzati: Clinical Department of Medical, Surgical and Health Sciences, Trieste University, Trieste, Italy

Luigi Principe: Microbiology and Virology Unit, Great Metropolitan Hospital “Bianchi-Melacrino-Morelli”, Reggio Calabria, Italy

Venera Costantino, Manuela Di Santolo, Marina Busetti: Microbiology Unit, Trieste University Hospital (ASUGI), Trieste, Italy

\*Corresponding author: Dr. Verena Zerbato, Infectious Diseases Unit, Trieste University Hospital (ASUGI), Piazza dell’Ospitale n° 1, 34125 Trieste, Italy - verena.zerbato@gmail.com

## Objectives

Early identification of infection-causing microorganisms through multiplex PCR panels enables prompt and targeted antibiotic therapy. This study aimed to assess the performance of the BioFire® Joint Infection Panel (BF-JIP) in analysing non-synovial fluid samples compared to traditional culture methods. To our knowledge this is the first study to evaluate BF-JIP in a broader context, beyond bone and joint infections. Some authors have explored the “off-label” use of other multiplex PCR panels. Micó *et al.* investigated the use of the blood FilmArray panel on non-blood samples (e.g. cerebrospinal, joint, pleural, ascitic and abscesses fluids, finding an overall concordance with culture-based methods of 75% [1]. Hirai *et al.* evaluated the blood FilmArray panel for bone and joint infection, showing a sensitivity of 100% when considering only pathogens that are included in the panel [2].

## Methods

We conducted a retrospective cohort study at Trieste University Hospital, Italy, including all hospitalized adult patients who had at least one non-synovial fluid sample tested by both the BioFire Joint Infection Panel (BF-JIP) and traditional culture methods (gold standard) between November 2022 and April 2024 (Fig 1). To assess the performance of the BF-JIP, a suite of statistical metrics was calculated, including percentage of positive agreement (PPA), percentage of negative agreement (NPA), positive predictive value (PPV), negative predictive value (NPV), enhanced detection, concordance (C), and accuracy (A).

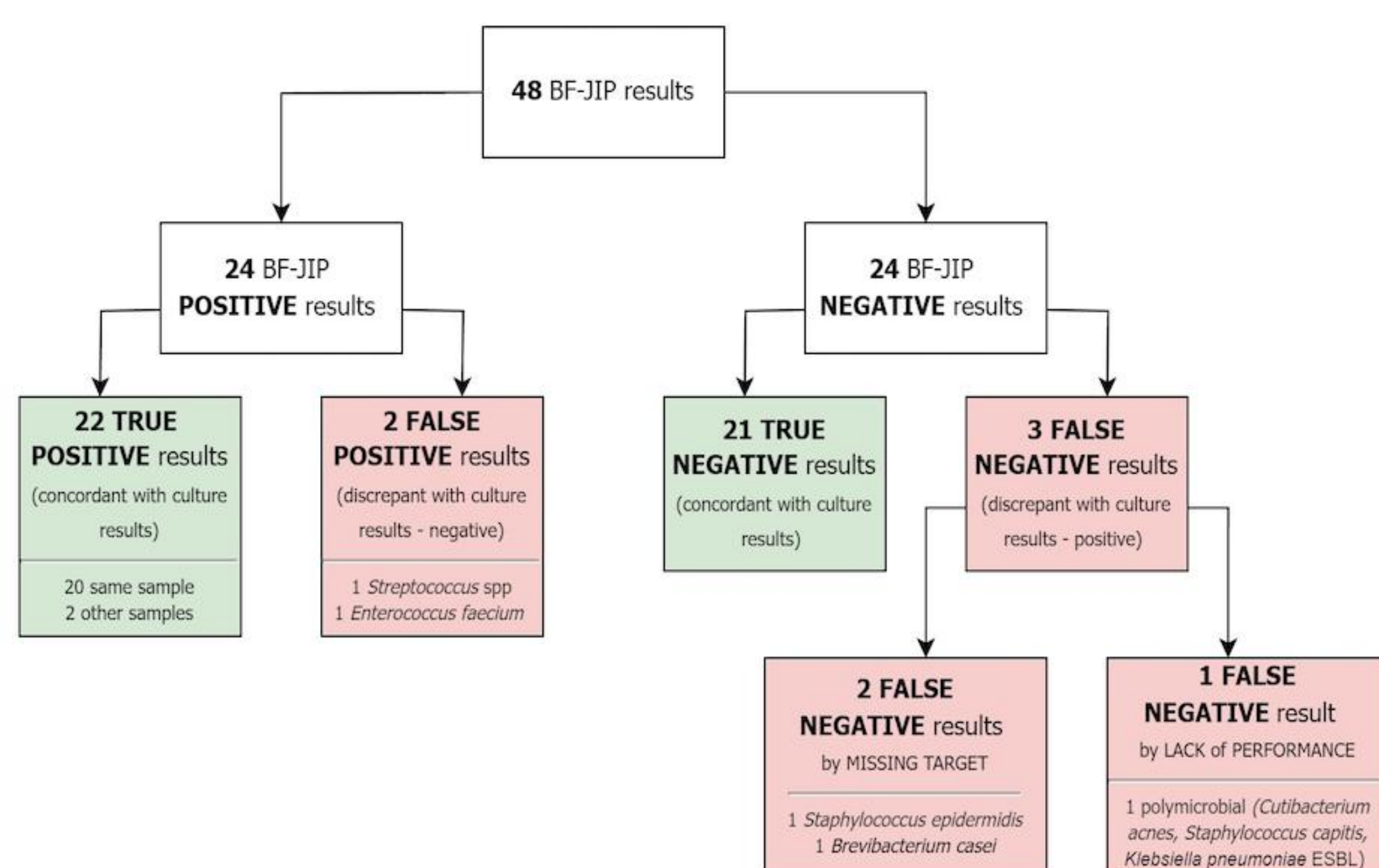


Fig 1: BioFire Joint Infection Panel (BF-JIP) compared with cultures

## Results

A total of 48 non-synovial fluid samples from 45 patients were evaluated, representing a diverse set of clinical scenarios. The patient cohort had a median age of 63 years, with a notable portion (67%) receiving antibiotic therapy at the time of sample collection. The types of samples included 24 abscess drainage fluids (e.g. cerebral, abdominal, skin and soft tissue abscesses, as well as infections related to breast implants), 10 biopsies (mainly bone tissue samples collected during surgical procedures), 6 pleural fluid samples, 5 cerebrospinal fluid (CSF) samples, 2 ascitic fluid samples, and 1 vitreous/aqueous humor sample. BF-JIP demonstrated an overall concordance rate of 85.4% with traditional culture methods, achieving particularly high accuracy in CSF samples, where it reached 100% concordance and accuracy (Table 1). Additionally, its accuracy was recorded at 89.6%.

| BF-JIP PERFORMANCES           |       |       |       |       |       |       |
|-------------------------------|-------|-------|-------|-------|-------|-------|
|                               | PPA   | NPA   | PPV   | NPV   | C     | A     |
| All samples (n=48)            | 88.0% | 91.3% | 91.7% | 87.5% | 85.4% | 89.6% |
| Abscess drainage fluid (n=24) | 100%  | 90.9% | 92.9% | 100%  | 91.7% | 95.8% |
| Biopsy (n=10)                 | 57.1% | 100%  | 100%  | 50%   | 70.0% | 70.0% |
| Pleural fluid (n=6)           | 100%  | 75%   | 66.7% | 100%  | 66.7% | 83.3% |
| Cerebrospinal fluid (n=5)     | 100%  | 100%  | 100%  | 100%  | 100%  | 100%  |

Table 1: Performances of the BF-JIP

A = accuracy; C = concordance; NPA = percentage of negative agreement; NPV = negative predictive value; PPA = percentage of positive agreement; PPV = positive predictive value.

The BF-JIP detected 42 bacteria and 2 fungi (Table 2), effectively identifying anaerobic bacteria in polymicrobial infections that traditional culture missed. This resulted in a 4.3% increase in the detection rate compared to standard culture methods. Even in patients undergoing antibiotic therapy, BF-JIP maintained robust performance. The comprehensive analysis confirmed BF-JIP's efficacy in critical samples such as CSF and abscess drainage fluids, highlighting its potential to improve patient management in complex clinical settings.

## Conclusions

The BF-JIP demonstrated strong performance in detecting pathogens in non-synovial fluid samples, with high concordance (85.4%) and 4.3% enhanced detection compared to traditional culture methods. Notably, its accuracy was 89.6%, consistent with previous studies on synovial fluid where BF-JIP showed excellent sensitivity and specificity, as well as faster turnaround times [3,4].

## References

- Micó M, Navarro F, de Miniac D, González Y, Brell A, López C, et al. Efficacy of the FilmArray blood culture identification panel for direct molecular diagnosis of infectious diseases from samples other than blood. *J Med Microbiol.* 2015;64: 1481-1488. doi:10.1099/jmm.0.000180
- Hirai J, Mori N, Sakanashi D, Morishita Y, Kuge Y, Kishino T, et al. Usefulness of the FilmArray blood culture identification panel for identifying causative pathogens of bone and joint infections. *J Infect Chemother.* 2023;29: 722-725. doi:10.1016/j.jiac.2023.04.011
- Esteban J, Salar-Vidal L, Schmitt BH, Waggoner A, Laurent F, Abad L, et al. Multicenter evaluation of the BIOFIRE Joint Infection Panel for the detection of bacteria, yeast, and AMR genes in synovial fluid samples. *J Clin Microbiol.* 2023;61: e0035723. doi:10.1128/jcm.00357-23
- Hoffman T, Kriger O, Cohen S, Gefen-Halevi S, Yahav D, Amit S. Real-Life Experience and Diagnostic Utility of the BioFire Joint Infection PCR Panel in Bone and Joint Infections: Analysis of a Prospective Validation Study. *Infect Dis Ther.* 2023;12: 1437-1443. doi:10.1007/s40121-023-00809-x