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Recognition of *Streptococcus pseudoporcinus* Colonization in Women as a Consequence of Using Matrix-Assisted Laser Desorption Ionization–Time of Flight Mass Spectrometry for Group B Streptococcus Identification

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During a 14-month period of using matrix-assisted laser desorption ionization–time of flight mass spectrometry (MALDI-TOF MS) for group B streptococcus (GBS) identification, we recovered 32 (1%) *Streptococcus pseudoporcinus* isolates from 3,276 GBS screening cultures from female genital sources (25 isolates from pregnant women and 7 from nonpregnant women). An additional two *S. pseudoporcinus* isolates were identified from a urine culture and a posthysterectomy wound culture. These isolates were found to cross-react with three different GBS antigen agglutination kits, PathoDx (Remel) (93%), Prolex (Pro-Lab Diagnostics) (38%), and Streptex (Remel) (53%). New approaches to bacterial identification in routine clinical microbiology laboratories may affect the prevalence of *S. pseudoporcinus*.

Streptococcus pseudoporcinus is a beta-hemolytic Gram-positive coccus that was identified as a separate and independent *Streptococcus* species in 2006 (1). *S. pseudoporcinus* has been isolated from the female genitourinary tract and has biochemical characteristics similar to those of *Streptococcus agalactiae*, which is also known as group B streptococcus (GBS) (1–3). The prevalence and clinical significance of genitourinary *S. pseudoporcinus* and its relationship to peripartum neonatal and maternal infections are not currently known (2, 3). In 2011, Stoner et al. (4) sought to identify the prevalence and epidemiology of *S. pseudoporcinus* in the genital tracts of nonpregnant women. They found that 5.4% of the women in their study had genital cultures positive for this bacterium. The cross-reactivity of standard GBS testing kits raises concerns that *S. pseudoporcinus* has been misidentified as GBS in routine GBS screening cultures (1–4). In addition, matrix-assisted laser desorption ionization–time of flight mass spectrometry (MALDI-TOF MS) analysis is coming to be routinely used for organism identification (5, 6). At the Johns Hopkins Hospital (JHH) microbiology laboratory, we became aware of *S. pseudoporcinus* identification from positive GBS screening cultures after the implementation of MALDI-TOF MS (Bruker Daltonics, Billerica, MA) for organism identification. Thus, we prospectively identified *S. pseudoporcinus* isolates from GBS screening cultures to determine the prevalence and clinical characteristics of patients with *S. pseudoporcinus* colonization.

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We identified *S. pseudoporcinus* and *S. agalactiae* from GBS screening cultures at the JHH between 1 April 2014 and 31 May 2015. Swabs from female genital sources were inoculated into Todd-Hewitt (TH) broth and onto 5% sheep blood agar (SBA; Remel, Lenexa, KS) plates. The broth was incubated at 35°C in a 5% CO_2 incubator for 18 to 24 h, subcultured onto 5% SBA, and then incubated for 18 to 24 h. Beta-hemolytic colonies from GBS screening cultures were identified by MALDI-TOF MS (Bruker Microflex, Biotyper software V.3.0, and database v.3.1.66) in accordance with the manufacturer's instructions. All isolates were tested in duplicate. The manufacturer's spectral cutoff score used for interpretation was >2.0 for identification to the species level. Suspected isolates of *S. pseudoporcinus* had their identification confirmed by sequencing of the first 500 bp of the 16S rRNA gene. Sequence identification was carried out with the PCR 500 and Sequencing 500 MicroSeq kits for bacterial identification (Life Technologies-Applied Biosystems, Foster City, CA). All procedures were performed in accordance with the manufacturer's instructions. Sequencing was performed on an ABI 3500 gene sequencer. Gene assembly, data searching, and generation of the final report were performed with software supplied by SmartGene, Inc. (Raleigh, NC). Sequencing scores were interpreted in accordance with guidelines established by the Clinical and Laboratory Standards Institute (7); that is, sequencing results matching the reference strains at a value of ≥99% were considered acceptable for identification to both the species and genus levels. Available isolates were tested for group B antigen with three commercial beta-hemolytic streptococcus agglutination test kits: PathoDx

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(Remel, Lenexa, KS), Prolex (Pro-Lab Diagnostics, Round Rock, TX), and Streptex (Remel, Lenexa, KS). Clindamycin and erythromycin susceptibility testing (Thermo Scientific Oxoid Clindamycin and Erythromycin Antimicrobial Susceptibility Disks; Remel, Lenexa, KS) for all *S. agalactiae* and *S. pseudoporcinus* isolates was performed in accordance with the Clinical and Laboratory Standards Institute interpretive guidelines (disk diffusion test) (8). To determine whether molecular assays designed for GBS detection directly from enrichment broth would detect *S. pseudoporcinus*, we randomly selected 10 *S. pseudoporcinus* isolates recovered from pregnant women for identification with the FDA-cleared PCR-based BD MAX GBS assay kit (Becton Dickinson, Sparks, MD). The isolates were inoculated into TH broth, and GBS identification was performed as previously described (9). In addition, we searched JHH microbiology laboratory reports for *S. pseudoporcinus* recovered from clinical cultures other than those performed to screen for GBS during the study period. Clinical characteristics of patients colonized with *S. pseudoporcinus* were reviewed. This study was approved by the Johns Hopkins University School of Medicine Institutional Review Board.

In 3,276 GBS screening cultures, 32 isolates (1.0%) of *S. pseudoporcinus* and 604 isolates (18.4%) of *S. agalactiae* were identified by MALTDI-TOF MS. With the manufacturer's cutoff for interpretation, 52.9% of suspected isolates were originally identified as *S. pseudoporcinus* by MALDI-TOF MS. The remainder, with identification scores of 1.7 to 1.999, were referred for 16S rRNA gene sequencing. Three antigen agglutination kits evaluated with *S. pseudoporcinus* isolates were found to be positive for B antigen agglutination as follows: PathoDx, 28/30 (93%; in accordance with the Centers of Disease Control and Prevention [CDC] interpretation) (3); Prolex, 13/34 (38.2%); Streptex, 16/30 (53%). In the PathoDx Strep group B latex reagent test, 17 *S. pseudoporcinus* isolates (57%) reacted strongly, 37% (14 isolates) showed a weak reaction (grainy agglutination), and 6% (2 isolates) did not react. The BD MAX GBS assay did not give a positive result for GBS screening of any of the *S. pseudoporcinus* isolates selected. In an analysis of antimicrobial susceptibility test results, a lower percentage of clindamycin and erythromycin resistance was found among *S. pseudoporcinus* isolates by GBS screening (5/32 [15.6%] and 5/32 [15.6%], respectively [Table 1]) than among *S. agalactiae* isolates (150/3,276 [45.8%] and 203/3,276 [62.0%], respectively [data not shown]; $P = 0.003$; odds ratio [OR], 3.859; 95% confidence interval [CI], 1.286 to 10.723 [clindamycin resistance]; $P = 0.029$; OR, 2.803; 95% CI, 0.938 to 7.752 [erythromycin resistance]).

Of 32 patients with *S. pseudoporcinus* colonization, 25 were pregnant and 7 were not pregnant (mean age, 27 years; range, 18 to 44 years) (Table 2). Thirty women (93.8%) were African American. All of the colonized patients with underlying obesity were pregnant. Five (16%) patients had underlying diabetes. Thirteen patients (40%) had a history of genitourinary infection. Among the 25 pregnant women, only 1 presented with a history of premature ruptured membranes and 4 developed a fever during delivery and infection of their infants was suspected. In our study, there was no patient with *S. pseudoporcinus* and *S. agalactiae* coinfection. The women who developed fever were positive only for *S. pseudoporcinus* colonization. Using the JHH microbiology laboratory GBS screening and identification protocol, we reported a positive GBS screening result if the isolates carried the B antigen by the Prolex test. We have reported positive GBS screening results for 13 *S. pseudoporcinus* isolates (9 isolates from pregnant women). However, 19 patients (76%) had received peripartum antimicrobial prophylaxis. The indication for antimicrobial prophylaxis included a positive GBS screening result, a planned caesarean section, and/or a suspected concomitant intrapartum infection such as a urinary tract infection (UTI) or chorioamnionitis. All of the GBS samples from nonpregnant women were collected from patients with a history of abnormal vaginal discharge, and vaginitis was suspected in all seven patients. Some patients had a history of dysuria and dyspareunia.

From the lab database search, we found an additional two isolates of *S. pseudoporcinus* that were identified by MALDI-TOF MS. One patient had a history of recurrent UTI. The patient presented with hematuria consistent with UTI. A urine culture also grew *Escherichia coli* along with *S. pseudoporcinus*. Another isolate was recovered from a surgical wound culture collected from a patient with a history of endometrial cancer who developed fever after a hysterectomy and had a pelvic abscess. This surgical wound culture also grew *Enterobacter aerogenes*, *S. anginosus*, and *Prevotella* species along with *S. pseudoporcinus*.

This study was a 14-month prospective observational study to evaluate recent data on the prevalence of *S. pseudoporcinus* at a single institution created as a consequence of beta-hemolytic streptococcus identification by MALDI-TOF MS. Although the clinical significance of *S. pseudoporcinus* is unclear, microbiologists and clinicians should be aware of this bacterium, as it seems to be associated with clinical syndromes similar to those that involve *S. agalactiae*. We found a lower prevalence of *S. pseudoporcinus* colonization in women than in previous studies in the United States (3, 4) and Canada (2) (Table 3). In those studies, the majority of the women with *S. pseudoporcinus* colonization were African American (3, 4) and from the Caribbean or sub-Saharan Africa (2). In our study, the majority of the women with *S. pseudoporcinus* colonization were also African American. In addition to *S. pseudoporcinus*, some (40%) of the patients were also found to have concomitant genitourinary infections or sexually transmitted diseases. These findings are consistent with previous studies (3, 4). Only four pregnant patients had fever, and infections were suspected in their neonates. We did not recover *S. pseudoporcinus* isolates from the blood or sterile sites of any patients during our study period. In contrast, the previous study reported that 5 (9.1%) of 55 clinical isolates of *S. pseudoporcinus* were collected from blood cultures (3). However, the majority (76%) of the colonized patients had received peripartum antibiotic prophylaxis, which may have impacted organism recovery from the febrile patients and/or prevented infections in those patients who were colonized.

Outside vaginal colonization and genitourinary infections in pregnant women, to date, only a case report of a thumb infection caused by *S. pseudoporcinus* has been reported in the literature (10). In our study, we recovered *S. pseudoporcinus* from a surgical wound that contained mixed pathogens and from the urine of a symptomatic patient who also had an *E. coli* UTI. Therefore, *S. pseudoporcinus* infection might not be associated with invasive disease to the same extent that *S. agalactiae* infection is. More studies are needed to address this hypothesis.

Previous studies reported variability of cross-reactivity of B antigen agglutination tests of *S. pseudoporcinus* isolates (Table 3) (1–4). In our study, close to 100% of the isolates gave a positive reaction with PathoDx, in contrast to the other kits. We found a

TABLE 1 Identification and susceptibilities of 34 *S. pseudoporcinus* isolates

No.	Specimen type[a]	Pregnant	Initial MALDI-TOF MS ID score[b]	BD MAX GBS test result[c]	Antigen agglutination test result[d]			Susceptibility[e] to:	
					PathoDx	Prolex	Streptex	Clindamycin	Erythromycin
1	Cervix	Yes	>2.0	NA	NA	STN	NA	R	R
2	Vagina	Yes	1.7–1.999	Negative	B	STN	STN	S	S
3	Vagina	Yes	1.7–1.999	Negative	B	B	B	S	S
4	Vagina	Yes	>2.0	Negative	B (weak)	STN	STN	S	S
5	Vagina	Yes	>2.0	NP	STN	STN	STN	S	S
6	Vagina	Yes	1.7–1.999	Negative	B (weak)	STN	STN	S	S
7	Vagina	Yes	>2.0	NA	NA	STN	NA	R	R
8	Vagina	Yes	>2.0	NA	NA	STN	NA	S	S
9	Vagina	Yes	1.7–1.999	Negative	B (weak)	B	STN	S	S
10	Vagina	Yes	1.7–1.999	Negative	B	STN	B	S	S
11	Vagina	Yes	>2.0	Negative	STN	STN	STN	S	S
12	Vagina	Yes	>2.0	NP	B (weak)	STN	STN	S	S
13	Vagina	Yes	>2.0	NP	B (weak)	STN	STN	R	R
14	Vagina	Yes	>2.0	Negative	B	STN	B	S	S
15	Vagina	Yes	1.7–1.999	Negative	B	B	B	S	S
16	Vagina	Yes	1.7–1.999	Negative	B	B	B	S	S
17	Vagina	Yes	1.7–1.999	NP	B	B	B	S	S
18	Vagina	Yes	>2.0	Negative	B	STN	B	S	S
19	Vagina	Yes	1.7–1.999	Negative	B	B	B	S	S
20	Vagina	Yes	1.7–1.999	Negative	B	B	B	S	S
21	Vagina	Yes	>2.0	Negative	B	B	B	S	S
22	Vagina	Yes	>2.0	NP	B	STN	B	S	S
23	Vagina	Yes	>2.0	NP	B (weak)	STN	STN	S	S
24	Vagina	Yes	>2.0	NP	B (weak)	STN	STN	S	S
25	Vagina	Yes	>2.0	NP	B	B	B	S	S
26	Cervix	No	1.7–1.999	NP	B (weak)	STN	STN	R	R
27	Vagina	No	1.7–1.999	NP	B (weak)	STN	STN	S	S
28	Vagina	No	1.7–1.999	NP	B	B	B	R	R
29	Vagina	No	1.7–1.999	NP	B	B	STN	S	S
30	Cervix	No	1.7–1.999	NP	B (weak)	STN	STN	S	S
31	Vagina	No	>2.0	NP	B	B	B	S	S
32	Vagina	No	>2.0	NP	B	B	B	S	S
33	Urine	No	>2.0	NA	NA	STN	NA	NA	NA
34	Wound	No	1.7–1.999	NP	B (weak)	STN	STN	R	R

[a] Vagina, vaginal-rectal sample.
[b] Subsequent MALDI-TOF MS identification scores of all available *S. pseudoporcinus* isolates (except isolates 1, 7, 8, and 33) were improved with the addition of more MSP entries to the library database.
[c] NA, isolate not available; NP, not performed.
[d] STN, *Streptococcus* nontypeable.
[e] S, susceptible; R, resistant.

higher percentage of strongly positive cross-reactivity of B antigen agglutination tests with PathoDx in accordance with the CDC interpretation than did the study of Shewmaker et al. (57% versus 14%) (3). Lower percentages of *S. pseudoporcinus* isolates had B antigen cross-reactivity with the Prolex and Streptex kits. A previous study reported that *S. pseudoporcinus* dairy isolates had no B antigen cross-reactivity with the PathoDx kit (3). This information may be useful when choosing GBS agglutination reagents. Although *S. pseudoporcinus* and *S. agalactiae* are beta-hemolytic Gram-positive cocci, *S. pseudoporcinus* has stronger hemolysis than *S. agalactiae*. The degree of beta-hemolysis observed can vary by the type of blood agar used for cultures. The combination of colony morphology and B antigen agglutination test results with a less cross-reactive kit would also help to suspect identification of the *S. porcinus*-*S. pseudoporcinus* complex (2, 3, 10).

In addition to conventional methods for GBS screening identification, we also reported the use of MALDI-TOF MS and BD MAX GBS assays for *S. pseudoporcinus* identification. With the manufacturer's cutoff score of 2, only 53% of the isolates were identifiable by MALDI-TOF MS. This poor identification performance was likely related to the limited number of the MS peak (MSP) entries in the database. There is only one MSP of *S. pseudoporcinus* in the manufacturer's database. Thus, all of the available *S. pseudoporcinus* isolates were reidentified by MALDI-TOF MS with additional isolates from the JHH database. In the JHH database, MSPs from three additional isolates confirmed as *S. pseudoporcinus* by 16S rRNA gene sequencing were added to the database. With the manufacturer's cutoff score of 2, MALDI-TOF MS was able to reidentify all (100%) of the *S. pseudoporcinus* isolates (data not shown). As expected, the BD MAX GBS assay is very

TABLE 2 Clinical characteristics of patients colonized with *S. pseudoporcinus*

No.[a]	Specimen type[e]	Pregnant	Age	Race[f]	Obesity[b]	Underlying disease(s)[g]	Peripartum antibiotic prophylaxis	*S. pseudoporcinus* clinical infection
1	Cervix	Yes	28	AA	No	Smoking	Cefazolin	No
2	Vagina	Yes	29	AA	Yes[c]	History of UTI, TV	Ceftriaxone	Fever during delivery, suspected neonatal infection
3[d]	Vagina	Yes	37	AA	No	No	Penicillin	No
4	Vagina	Yes	28	AA	Yes	Smoking, history of HSV	Clindamycin	No
5	Vagina	Yes	25	AA	No	NA	NA	NA
6	Vagina	Yes	44	AA	Yes[c]	History of CT	Penicillin	No
7	Vagina	Yes	21	W	Yes[c]	Smoking	Cefazolin	No
8	Vagina	Yes	33	AA	Yes[c]	DM	Penicillin	No
9[d]	Vagina	Yes	27	AA	Yes	No	No	Fever during delivery, suspected neonatal infection
10	Vagina	Yes	29	AA	Yes	No	No	No
11	Vagina	Yes	28	AA	Yes	No	Penicillin	No
12	Vagina	Yes	27	AA	Yes[c]	DM	No	No
13	Vagina	Yes	30	AA	Yes[c]	DM, smoking, history of HSV	Cefazolin	No
14	Vagina	Yes	27	AA	Yes	DM, history of HSV	No	No
15[d]	Vagina	Yes	23	AA	Yes	Smoking	Clindamycin	No
16[d]	Vagina	Yes	21	AA	No	Smoking, history of UTI, CT, BV	Ampicillin, gentamicin	Fever during delivery, suspected neonatal infection
17[d]	Vagina	Yes	18	AA	No	No	No	No
18	Vagina	Yes	23	AA	No	History of GC, CT, BV	Cefazolin	No
19[d]	Vagina	Yes	30	AA	Yes	History of GC, CT	Penicillin	No
20[d]	Vagina	Yes	24	AA	Yes[c]	History of GC, CT	Penicillin, cefazolin	No
21[d]	Vagina	Yes	26	AA	No	DM	Penicillin, cefazolin	No
22	Vagina	Yes	25	AA	Yes[c]	History of CT	Penicillin	No
23	Vagina	Yes	25	AA	Yes[c]	UTI	Cefazolin	No
24	Vagina	Yes	26	AA	Yes	Smoking, history of GC, TV	Penicillin, cefazolin	Fever during delivery, suspected neonatal infection
25[d]	Vagina	Yes	26	AA	Yes[c]	Premature ruptured membranes	Penicillin, cefazolin	No
26	Cervix	No	27	AA	No	No	NA	Vaginitis, UTI
27	Vagina	No	24	AA	No	No	NA	Vaginitis
28[d]	Vagina	No	26	AA	No	History of GC	NA	Vaginitis, positive GC NAAT
29[d]	Vagina	No	23	AA	No	No	NA	Vaginitis
30	Cervix	No	39	AA	No	History of BV	NA	Vaginitis
31[d]	Vagina	No	25	NA	No		NA	Vaginitis and dyspareunia
32[d]	Vagina	No	21	AA	No	No	NA	Vaginitis and *Trichomonas* infection
33	Urine	No	32	W	NA	Multiple sclerosis, recurrent UTI	NA	UTI, hematuria, urine culture grew *E. coli* and *S. pseudoporcinus*
34	Wound	No	50	AA	NA	DM, endometrial cancer	NA	Posthysterectomy with fever, pelvic abscess with mixed infection

[a] Thirty-two *S. pseudoporcinus* isolates were recovered from female genital sources, and two *S. pseudoporcinus* isolates were from nongenital sources (urine culture and posthysterectomy wound culture).
[b] Obesity was defined as a prepregnancy body mass index of ≥30.
[c] Morbid obesity was defined as a prepregnancy body mass index of ≥40.
[d] Using the JHH microbiology laboratory GBS screening and identification protocol, we reported a positive GBS screening result if the isolates were found to carry the B antigen by the Prolex test.
[e] Vagina, vaginal-rectal sample.
[f] AA, African American; W, white.
[g] NA, data not available; BV, bacterial vaginosis; CT, *C. trachomatis* infection; DM, diabetes mellitus; GC, gonococcal infection; HSV, herpes simplex virus infection (genital herpes); NAAT, nucleic acid amplification test; TV, *T. vaginalis* infection.

specific for the detection of *S. agalactiae* (10) and no false-positive results with *S. pseudoporcinus* isolates were seen in our limited testing.

Although the prevalence of *S. pseudoporcinus* colonization of women in our hospital was low, we found a higher rate of clindamycin and erythromycin resistance (18% for both) than in previous studies (0 to 3%) (Table 3) (2–4). Previous studies reported that *S. pseudoporcinus* is highly susceptible to β-lactam antibiotics (2, 3).

Our study had some limitations. This was a prospective observational study performed at a single institution. The patient population might be different from that in other places. At the JHH

TABLE 3 Epidemiology, phenotypic characteristics, and antibiotic susceptibilities of *S. pseudoporcinus* clinical isolates

Parameter	Characteristic of reference study				
	This study	1	2	3	4
Yr or period of isolate collection (duration)	2014–2015 (14 mo)	1995–2005	1997–2006	1984–2010	2006 (18 mo)
Location(s)	MD, USA	Quebec, Canada	Quebec, Canada	United States, Brazil	United States[a]
Patient type(s)	Women	Women	Pregnant women	Men, women[b]	Nonpregnant women
No. of *S. pseudoporcinus* isolates	32 female genital cultures,[c] 1 urine culture, 1 wound culture	9 female genital cultures	14 female genital cultures, 1 urine culture	72 human sources[d]	120 female genital cultures (36 patients)
Mean (range) or range of patient ages (yr)	27 (21–44)	30 (21–49)	33 (21–43)	NA	30–40
% *S. pseudoporcinus* colonization prevalence (no. colonized/total)	1 (32/3,276)	NA[i]	NA	NA	5.4 (36/663)
No. (%) of isolates with positive GBS typing, antigen agglutination kit (company)	28 (93), PathoDx (Remel),[e] 13 (38), Prolex (Pro-Lab), 16 (53), Streptex (Remel)	0 (0), Streptex (Murex)	14 (93), PathoDx (Remel)[f]	60 (83), PathoDx (Remel)[g]	120 (100), PathoDx (Remel)[h]
Susceptibility test type	Disk diffusion	NA	Disk diffusion	Broth microdilution	NA
No. (%) of isolates susceptible to:					
Clindamycin	27[g] (82)	NA	15 (100)	70 (97)	NA
Erythromycin	27[g] (82)	NA	15 (100)	70 (97)	NA

[a] Pittsburgh, PA; Augusta, GA; and Houston, TX.
[b] Three men, 50 women (available clinical characteristics of 50 of 59 patients).
[c] Twenty-five pregnant, 7 nonpregnant.
[d] Blood, wound, cervix, vagina, placenta, throat.
[e] Using the CDC interpretation, PathoDx GBS latex reagent testing revealed that 17 *S. pseudoporcinus* isolates (57%) reacted strongly and 14 (37%) reacted weakly.
[f] Using Upitt interpretation (4).
[g] Using the CDC interpretation, PathoDx GBS latex reagent testing revealed that 10 *S. pseudoporcinus* isolates (14%) reacted strongly and 50 (69%) reacted weakly.
[h] Thirty-three isolates were available for susceptibility testing.
[i] NA, data not available.

microbiology laboratory, we no longer use conventional biochemical testing for GBS or *S. agalactiae* confirmation. Thus, the hippurate hydrolysis test and CAMP test were not performed. We did not perform antimicrobial susceptibility testing by the broth microdilution method, and we did not test for β-lactam antibiotic susceptibility.

In conclusion, new approaches to bacterial identification in routine clinical microbiology laboratories may affect the prevalence of *S. pseudoporcinus*. The rate of clindamycin and erythromycin resistance we found among *S. pseudoporcinus* isolates was higher than that in previous studies but lower than that observed for GBS. The clinical significance of genitourinary *S. pseudoporcinus*, patients' clinical characteristics, and their relationship to peripartum neonatal and maternal infections requires further investigation.

REFERENCES

1. **Bekal S, Gaudreau C, Laurence RA, Simoneau E, Raynal L.** 2006. *Streptococcus pseudoporcinus* sp. nov., a novel species isolated from the genitourinary tract of women. J Clin Microbiol **44:**2584–2586. http://dx.doi.org/10.1128/JCM.02707-05.
2. **Gaudreau C, Simoneau E, Labrecque O, Laurence RA, Laferrière C, Miller M, Raynal L, Rallu F.** 2007. Epidemiological, biochemical and antimicrobial susceptibility characteristics of *Streptococcus pseudoporcinus* isolated in Quebec, Canada, from 1997 to 2006. J Med Microbiol **56**(Pt 12)**:**1620–1624. http://dx.doi.org/10.1099/jmm.0.47295-0.
3. **Shewmaker PL, Steigerwalt AG, Whitney AM, Morey RE, Graziano JC, Facklam RR, Musser KA, Merquior VL, Teixeira LM.** 2012. Evaluation of methods for identification and determination of the taxonomic status of strains belonging to the *Streptococcus porcinus-Streptococcus pseudoporcinus* complex isolated from animal, human, and dairy sources. J Clin Microbiol **50:**3591–3597. http://dx.doi.org/10.1128/JCM.01481-12.
4. **Stoner KA, Rabe LK, Austin MN, Meyn LA, Hillier SL.** 2011. Incidence and epidemiology of *Streptococcus pseudoporcinus* in the genital tract. J Clin Microbiol **49:**883–886. http://dx.doi.org/10.1128/JCM.01965-10.
5. **Clark AE, Kaleta EJ, Arora A, Wolk DM.** 2013. Matrix-assisted laser desorption ionization–time of flight mass spectrometry: a fundamental shift in the routine practice of clinical microbiology. Clin Microbiol Rev **26:**547–603. http://dx.doi.org/10.1128/CMR.00072-12.
6. **Wojewoda C.** 2013. Pathology consultation on matrix-assisted laser desorption ionization–time of flight mass spectrometry for microbiology. Am J Clin Pathol **140:**143–148. http://dx.doi.org/10.1309/AJCPU0AYZ5SYQIUK.
7. **Clinical and Laboratory Standards Institute.** 2008. Interpretive criteria for identification of bacteria and fungi by DNA target sequencing; approved guideline CLSI MM18-A. Clinical and Laboratory Standards Institute, Wayne, PA.
8. **Clinical and Laboratory Standards Institute.** 2015. Performance standards for antimicrobial susceptibility testing; twenty-fifth informational supplement CLSI M100-S25. Clinical and Laboratory Standards Institute, Wayne, PA.
9. **Riedlinger J, Beqaj SH, Milish MA, Young S, Smith R, Dodd M, Hankerd RE, Lebar WD, Newton DW.** 2010. Multicenter evaluation of the BD MAX GBS assay for detection of group B streptococci in prenatal vaginal and rectal screening swab specimens from pregnant women. J Clin Microbiol **48:**4239–4241. http://dx.doi.org/10.1128/JCM.00947-10.
10. **Mahlen SD, Clarridge JE, III.** 2009. Thumb infection caused by *Streptococcus pseudoporcinus*. J Clin Microbiol **47:**3041–3042. http://dx.doi.org/10.1128/JCM.00802-09.