INTRODUCTION

In today’s competitive healthcare industry, automation is at the forefront when it comes to streamlining operations and advancing patient care. Automation has also gained a foothold in the laboratory, generating significant gains in productivity and changing many outdated operations. Microbiology labs are facing growing pressure from a variety of sources such as the shortage of skilled laborers and increase in work volume, making the argument for automation quite compelling. Moreover, automating the microbiology laboratory is not easy, the effort is challenged by the variety of specimens, volumes, containers, and processing methodologies involved. Without automation and standardization as part of sample collection and handling, the chance that misidentification or cross-contamination of specimens will occur increases.

The present study was performed between 30 June and 29 July 2008 in our routine clinical microbiology laboratory in order to compare the new PREVI Isola system to the manual routine method for plate streaking in terms of performance and time saving.

MATERIAL AND METHODS

Material:
The following samples coming from the microbiology routine of the lab were included in the study:
- 536 urine specimens (147 [27.4%] of which were sterile),
- 385 fecal specimens,
- 137 wound swabs (60 [43.8%] of which remained sterile),
- 48 ENT swabs (24 [50.0%] of which remained sterile).

Methods:
Manual: In order to obtain well-isolated discrete colonies with the manual method, the quadrant streak technique was used.

Automated: The PREVI Isola (bioMérieux, France) is a new automated system (Figure 1 & 2) able to perform the inoculation and streaking of Prepared Media (PPM) with liquid microbiological samples.

According to the specimen type and data previously introduced in the system, the instrument selects the media to inoculate, applies a radial inoculum onto the agar plate, and performs circular streaking with a disposable applicator (Figure 3).

Quality control: It consisted of testing a suspension of E. coli at 10^9 CFU/mL in NACI 0.45g/l on two TSA plates. Number of isolated colonies, surface of growth and streaking anomalies were counted and compared to acceptance criteria.

During this study, we assessed the performance of the PREVI Isola versus manual methodology in performing streaking. The quality of the automated streaking was described as lower, equivalent or higher to the manual streaking using two criteria:

a) Isolates must reflect the specimen’s microbiological status (polymicrobial sample, presence of pathogen),
b) Isolates must present enough isolated colonies to allow the required identification and susceptibility tests to be performed afterwards.

We also evaluated the workload level compared to the manual streaking method in a routine laboratory context.

RESULTS

Performance:

Urine specimens:
Regarding the number of isolated, further processable colonies, the PREVI® Isola method (PIM) was superior to the manual method (MM) in 161/389 cases (41.4%) for CPS agar, in 167/389 cases (42.9%) for Columbia blood agar (CBA), and in 55 cases for Colistin-Nalidixic acid agar (CNA). (21.7%, because growth was detected only on 254 plates). The colony isolation rate for PIM was inferior to the MM rate in 40 cases (10.3%) for CPS, 55 (14.1%) for CBA, and in 43 cases (16.9%) for CNA, respectively. In all other clinical specimens, similar results were observed for both PIM and MM.

In only 1/389 cases (0.25%), no growth was observed with the PIM but growth was detected with the MM whereas in 8/389 cases (2.1%) growth was detected with the PIM but not with the MM. On 29/389 occasions (7.2%), the PIM provided enough colonies to continue the analyses but not the MM whereas the opposite was true in only 8/389 (2.1%) of the cases.

Regarding the total colony count of single usable colonies using the PIM methodology, we detected the following: 3739 on CPS, 3400 on CBA, and 1821 on CNA. In contrast, the MM produced only the following total colony count of single isolated colonies: 2179 on CPS, 2084 on CBA, and 1690 on CNA. Therefore, the PIM produced 71.6% more usable colonies on CPS, 63.1% more colonies on CBA, and 7.8% more colonies on CNA than the MM.

Fecal specimens:
The overall incidence rate of Salmonella infections was 11.4% (44/385), the incidence of Campylobacter infections was 2.9% (11/385), and two individuals had double infections with both enteric pathogens. All Campylobacter infections were detected by both PIM and MM but PIM detected 45.2% (106 instead of 73) more isolated colonies in the 11 cases than the MM. Both PIM and MM detected Salmonella infections in 2944 (65.9%) cases whereas the MM alone detected 9 further cases (20.5%) and the PIM detected 6 further cases (13.6%). This might be due to the, for a long time known, uneven distribution of Salmonella strains and sampling.

Again, the PIM was more sensitive (22.4% for Leifson agar, 16.7% for SS-agar) than the MM by detecting 120 isolated colonies vs. 96 on Leifson agar and 77 vs. 66 on SS-agar, respectively.

Wound swabs:
PIM was superior in 48/77 cases (62.3%) on the CBA aerobic plates, in 14/29 cases (43.8%); growth was detected on Mac Conkey agar was detected in 28 of 77 cases only on Mac Conkey agar, in 41/67 (61.2%) on CNA, and on 38/63 (60.3%) anaerobic plates. The MM was superior in 2/77 (2.6%) on CBA aerobic, in 5/29 (17.2%) on Mac Conkey, in 1/67 (1.5%) on CNA, and in 3/63 (4.8%) on anaerobic CBA.

In none of the 77 wound swab cases did the MM generate more and enough colonies for further processing when compared with the PIM whereas in 27/77 cases (2.6%) the PIM allowed a faster processing of the cultured material than MM.

ENT swabs:
PIM was superior in 16/24 cases (66.7%) on CBA, in 6/11 cases (54.5%) on Mac Conkey agar, in 11/19 cases (57.9%) on CNA, and in 5/23 cases (21.7%) on Chocolate agar. The PIM was inferior in 4/11 cases (36.4%) on Mac Conkey agar, 1/19 cases (5.3%) on CNA, and 5/23 cases (21.7%) on Chocolate agar.

In 7/24 cases (29.2%) did the PIM yield enough colonies for further processing but the MM not whereas in only 1/24 cases (4.2%) did the MM produce more processable colonies than the PIM. It is quite interesting to note that (although the number of plates which were included in the study was relatively low for the swab materials) for both totally independently processed wound and ENT swabs, the PIM was superior to the MM in a relatively narrow range from 54.5% to 66.7% for the main growth media.

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Time measurement:
Native urines were included in this study. The agar media used were chromID CPS, Columbia blood agar and CAN.

The time measurement was performed by two persons to record all the steps needed from collection to plates streaking for both methods. (see table below)

The results obtained are summarized in the table below:

<table>
<thead>
<tr>
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<th>PREVI Isola</th>
<th>Manual Method</th>
<th>Time saving %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average time to perform 1 isolate samples (min/disk)</td>
<td>2.55 minutes</td>
<td>5.14 minutes</td>
<td>52.3%</td>
</tr>
<tr>
<td>Average time to perform 1 swab samples (min/disk)</td>
<td>3.01 minutes</td>
<td>8.53 minutes</td>
<td>64.7%</td>
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</tbody>
</table>

CONCLUSION

The results of our study show that the PREVI Isola system produces a higher number of colonies suitable for further characterization than the manual streaking method.

Time measurements obtained for urines demonstrated a significant time saving. This time saving could be enhanced for specimens such as feces and swabs for which a better quality of streaking has been shown previously with PREVI Isola.

Further evaluations in clinical laboratories with larger numbers of clinical specimens are needed to prove the suitability of this new system.