Two-step identification of Shiga-toxigenic Escherichia coli (STEC) with chromogenic media (CGM) and enzyme immunoassay (EIA) from human stool samples

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INTRODUCTION

Background

• Both O157 and non-O157 STEC infections can cause severe illness, and are associated with outbreaks worldwide.
• Recommendations require culture for O157 STEC, and an assay that distinguishes Shiga toxins for non-O157 STEC. Molecular assays targeting stx genes are the most sensitive, but are not available commercially. Immunoreassays are available commercially, but the sensitivities may be low. Both methods are also expensive for universal screening, considering the low prevalence of STEC infections.1,2 However, both methods have high specificities.3

Recently, STEC CGM have been introduced. These detect the most common STEC strains, including O157, O26, O45, O111, O113, O121, O123, and O125.4 Previous evaluations found sensitivities of 85-95% and specificities of 84-90% compared against PCR and cytotoxin assays, but low positive predictive values (PPVs) of 40-60%.

• This limitation of CGM may be overcome by having a confirmatory step with a Shiga toxin EIA (ST EIA).

Study Objectives

1. In this study, we evaluated the performance of a two-step approach consisting of a screening CGM followed by confirmatory STEC EIA (CGM vs. EIA 2 step) as an approach for universal testing of STEC in stools.

2. Cost analysis was also performed in a low prevalence setting, and compared with other methods.

METHODS (cont.)

Table 1 – EIA Performance: A) EIA vs PCR results. B) Performance compared with other studies.

| Table 1 – Comparison of STEC positivity and serotypes between the two 18-month periods
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<thead>
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<th>a)</th>
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<tr>
<td>PCR</td>
<td>EIA</td>
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<tr>
<td>E</td>
<td>56</td>
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<td>S</td>
<td>573</td>
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RESULTS

Phase 2

• Shiga Toxin Quik Chek (Colace, St Louis, MO) was evaluated on 175 STEC positive stool samples. This EIA was positive for 94.9% of STEC positive stool samples. In the second phase, 260 STEC positive stool samples were tested for Shiga toxin. However, the positive predictive value was low, 8.5%, likely reflecting the low prevalence compared to other studies.

• STEC CGM were also discontinued during the evaluation of STEC CGM, as the latter is also limited in sensitivity against PCR and cytotoxin assays, but low positive predictive values (PPVs) of 40-60%.

• The sensitivity of this approach is the multiplication of the sensitivity of each CGM and EIA. The specificity is that of EIA for PCR. The inclusion of the steps in all the coloured boxes is the current laboratory protocol.

• This study also examines the performance of an additional assay for STEC screening, the Shiga toxin EIA (ST EIA), which is 100% sensitive against STEC CGM, and 100% specific against PCR and cytotoxin assays.

• The sensitivity and specificity of this approach are not limited by the low prevalence of STEC in general, and the study results are applicable to laboratories that perform STEC screening.

• The addition of the Shiga toxin EIA to the current laboratory protocol will allow for the confirmation of STEC infections in a cost-effective and efficient manner.

• The study results can be used to support the implementation of STEC screening in other laboratories, and to inform future research on STEC screening.

REFERENCES


ACKNOWLEDGEMENTS

We are grateful to Alere for providing the reagents necessary for the second phase of this evaluation. We also thank Dr. Linda Chiu for her insight and expertise of the study.

Received Mar 3, 2014; Accepted May 31, 2014