Improving prenatal HIV screening with tailored educational interventions: an approach to guideline implementation

B A Prairie,¹ T Foster²

ABSTRACT
Background A healthy, uncomplicated pregnancy undergoes approximately 13 tests performed over an average of 12.5 prenatal visits. Published rates of compliance with routine prenatal testing are generally >90%, with lower rates for newer tests or those that require additional inputs prior to ordering. New CDC guidelines for prenatal HIV testing highlight the importance of prenatal testing and motivated the authors to explore our routine prenatal testing performance. The authors found the conceptual framework of simple/complicated/complex problems in healthcare helpful in understanding the rates for tests and for developing interventions.

Methods The setting for this work was a single, rural, academic tertiary care centre. Baseline rates of four routine prenatal tests (HBsAg, 1 h GTT, GBS, HIV) were determined by analysing 12 months of data from a web-based delivery registry. All rates were >90% except HIV, which was 79.2%. Process mapping and discussions with ordering providers were performed to plan the improvement intervention. Targeted educational interventions specific to each ordering provider type were followed by audit and feedback. HIV testing rates were monitored and analysed monthly using process control charts.

Results The HIV testing rate increased significantly from 79.2% to 94.2%. Rates greater than 90% were maintained for 10 of 11 months reported.

Conclusions Targeted educational interventions combined with audit and feedback can increase rates of routine testing successfully in an outpatient setting. These interventions can be used to improve implementation and compliance with new guidelines when informed by an understanding of local context and processes coupled with an appropriate conceptual framework.

INTRODUCTION
Prenatal screening in the outpatient setting is a major component of antenatal care. A healthy woman with an uncomplicated pregnancy will undergo approximately 13 tests over an average of 12.5 prenatal visits.¹ Many tests are performed during the first visit, but others occur at specific gestational ages or are required based on risk. Table 1 illustrates current prenatal tests recommended by the American College of Obstetricians and Gynecologists and the American Academy of Pediatrics in the USA.¹ Routine tests are required for everyone; optional tests are common and may be recommended but not required.

The Centers for Disease Control and Prevention (CDC) issued new guidelines on HIV screening in the adult population, including recommendations for universal, opt-out screening for prenatal patients.² Establishing the HIV status of pregnant women is important because treatment can reduce vertical transmission to less than 1% in the first world and significantly reduce maternal morbidity and mortality.³ These new guidelines motivated us to determine the reliability of our routine prenatal testing.

The specific aims for this work were: (1) to determine baseline screening rates for routine prenatal tests; (2) to characterise the setting and process of testing; (3) to design, implement and measure the effect of interventions to ensure reliable prenatal testing. Four specific routine prenatal tests (Hepatitis B surface antigen (HBsAg), 1 h glucose tolerance test (1 h GTT, a screen for gestational diabetes), Group B Streptococcus (GBS) and HIV) were selected because each test represented a different clinic process, and test rates were available in our electronic delivery registry.

METHODS
This project was submitted to the Dartmouth College/Dartmouth-Hitchcock Committee for the Protection of Human Subjects and determined not to meet criteria for human subjects research (CPHS # 20995).

Setting The setting for this work was a general obstetrical practice team in a single, rural, academic tertiary care centre located in New Hampshire and serving residents of NH and Vermont. These states generally have good pregnancy outcomes, and most women receive early prenatal care.⁴ The HIV incidence rate in NH in 2007 was 2.7/100 000, compared with a national average of 22.8/100 000 in 2006.⁵ ⁶ Prenatal care is provided by general obstetrician–gynaecologists (including residents), certified nurse midwives, and maternal–fetal medicine subspecialists. Our work focused on the general obstetric team that cares for about 320 pregnant women per year. The patient population is generally healthy, white and 14% Medicaid. Patients are assigned to one of four obstetric teams, each consisting of attending physicians, resident physicians, a clinical secretary and an advanced practice nurse (NP).

The presence of the Leadership Preventive Medicine Residency in our institution, with a member of the generalist ob/gyn team also a combined ob-gyn/LFM resident, allowed a unique opportunity to have a dedicated improvement
Baseline rates of four routine prenatal tests were determined by analysing 12 months of data from our web-based delivery registry. A chart review showed the registry to be 98.2% accurate. Baseline rates were >90% for three of the tests (HBsAg, 1 h GTT and GBS) but were only 79.2% for HIV. This suggested that HIV testing differed from other routine prenatal tests, and our third aim was therefore modified to focus on prenatal HIV testing as an opportunity for improvement.

As a first step in investigating this difference, process mapping was used to learn how, when and by whom prenatal HIV tests were ordered. Process mapping was conducted by a team of four: two front-line providers and two outside observers from a healthcare quality-improvement class. Process maps were generated in MS PowerPoint (Microsoft, Seattle, Washington) and reviewed by all four team members. Both a high-level and a detailed flow chart were generated in order to facilitate understanding of the process and development of targets for intervention. Process maps were reviewed with multiple stake-holders and revised appropriately. Patients entered prenatal care through one of three possible paths, and HIV testing could be offered at multiple points (see figure 1).

We also assessed provider knowledge/attitudes/beliefs via informal conversations regarding prenatal HIV testing. Knowledge gained from these efforts led to planning for an educational intervention. The decision for an educational intervention was based on an apparent lack of provider knowledge about both the guidelines and our performance, as well as the construct of simple, complicated and complex problems. The plan, do, study, act (PDSA) QI cycle framework was used to guide planning and implantation.

We believed that HIV testing was unlike other prenatal tests in our setting. Liu et al. have applied Glouberman and Zimmerman’s framing of problems as simple, complicated or complex to an inpatient care setting. We found this model

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Recommended routine and optional prenatal tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gestational age</strong></td>
<td><strong>First trimester</strong></td>
</tr>
<tr>
<td>Routine tests</td>
<td>Blood type and antibody screen</td>
</tr>
<tr>
<td></td>
<td>Haemoglobin or haematocrit</td>
</tr>
<tr>
<td></td>
<td>Urinalysis</td>
</tr>
<tr>
<td></td>
<td>Urine culture</td>
</tr>
<tr>
<td></td>
<td>Rubella immunity</td>
</tr>
<tr>
<td></td>
<td>Syphilis screen</td>
</tr>
<tr>
<td></td>
<td>Chlamydia screen</td>
</tr>
<tr>
<td></td>
<td>Hepatitis B surface antigen</td>
</tr>
<tr>
<td></td>
<td>HIV testing</td>
</tr>
<tr>
<td>Optional tests</td>
<td>Screening for trisomies 21, 18</td>
</tr>
<tr>
<td></td>
<td>Screening for cystic fibrosis</td>
</tr>
<tr>
<td></td>
<td>Pap smear</td>
</tr>
</tbody>
</table>

Figure 1  HIV ordering process.
Table 2 Glouberman and Zimmerman’s model of simple, complicated and complex (adapted with permission from Liu et al 15)  

<table>
<thead>
<tr>
<th>Example task</th>
<th>Simple</th>
<th>Complicated</th>
<th>Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-clinical</td>
<td>Baking a cake</td>
<td>Sending a rocket to the moon</td>
<td>Raising a child</td>
</tr>
<tr>
<td>Clinical</td>
<td>Screening for a urinary tract infection</td>
<td>Screening for gestational diabetes</td>
<td>Screening for HIV</td>
</tr>
<tr>
<td>Process</td>
<td>Recipe or set of instructions is necessary</td>
<td>Formulae are critical and necessary for success</td>
<td>Formulae and recommendations are useful but limited in application</td>
</tr>
<tr>
<td>Expertise required</td>
<td>None, but previous experience can improve success</td>
<td>High levels of expertise and specialised coordination of resources are necessary</td>
<td>Expertise can contribute but is not necessary or sufficient to ensure success</td>
</tr>
<tr>
<td>Uniqueness of outcome</td>
<td>A good recipe produces the same result every time</td>
<td>Following the formulae should ensure similar outcomes</td>
<td>Each outcome is unique</td>
</tr>
<tr>
<td>Expected outcome</td>
<td>The same result every time</td>
<td>High degree of certainty of outcome if formulae are followed correctly</td>
<td>Outcome is uncertain and cannot be reliably predicted beforehand</td>
</tr>
</tbody>
</table>

helpful for understanding why HIV testing was different and for developing appropriate interventions. Table 2 describes this model, with examples of its application in our setting.

HIV testing represented a complex process: patient and provider beliefs influence testing, there is potential associated stigma, and the clinic process included additional steps not required for any other tests. Complex problems are best addressed when patients’ and providers’ aims are shared and explicit. A complex process such as HIV testing would not be amenable to solutions such as checklists or algorithms but would require a multifaceted approach accounting for dynamic process relationships.

Choosing the intervention

Passive education alone may increase awareness, but most studies show this does not translate into a change in practice or behaviour for obstetric providers.13–15 Continuing medical education conferences also have little effect on practice.16 However, education used as one component of a multifaceted intervention may be effective in changing behaviour.17 18

Process analysis demonstrated that the three different provider groups for the general obstetric team (attending physicians, residents and advanced practice nurses) differed in their practices and attitudes. Therefore, the content and context for the planned educational interventions were customised. Residents received a didactic lecture followed by role play and discussion; nurse practitioners received an informational hand-out with an informal discussion using modified consensus process; attending physicians were visited for one-on-one conversations.

These educational sessions were also used to prepare for the next step: team-level audit and feedback of HIV testing performance. Interactive discussions about the frequency and nature of feedback to maximise utility were undertaken. We prepared a data wall in the clinic and held regular meetings with each team. Teaching teams to seek feedback, and incorporating knowledge about testing into the team function, was included to address sustainability. Educational sessions were held from March through October of 2007; audit and feedback began in October 2007. Table 3 reviews the various interventions, underlying rationale and timeline of implementation.

Measures and analysis

The primary outcome for this intervention was the percentage of generalist patients who received a prenatal HIV test prior to admission for delivery. At the time of admission for delivery, information about the pregnancy, including prenatal testing, is entered into a web-based delivery registry (OBNet, OBNet Services LLC). Monthly reports were generated from the registry. A data analysis was performed monthly using Microsoft Excel to generate control charts of testing rates for prenatal labs. Statistical process control charts were used given the ongoing nature of the improvement work and the ability to characterise variation in the process.19 This also allowed ongoing monitoring. P charts were reviewed monthly for special cause signals, indicating a significant change in the process beyond normal variation, and standard rules were used to identify special cause signals.20 The analysis presented here is from March 2007 to June 2008.

RESULTS

HIV screening rates are shown in figure 2. The HIV testing rate increased significantly from 79.2% to 94.2% with rates greater than 90% maintained for the 10 of 11 months reported. Continuing high screening rates suggest this intervention successfully built in sustainability. There were no new diagnoses of HIV and no positive tests. No significant changes were seen in the rates of Hep B, 1 h GTT or GBS tests tracked during the study period. The control chart was split when the special cause

Table 3 Summary of improvement interventions

<table>
<thead>
<tr>
<th>Start date</th>
<th>End date</th>
<th>Intervention/action</th>
<th>Rationale</th>
<th>Planned measure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/06</td>
<td>3/07</td>
<td>Characterise setting</td>
<td>Understand current processes</td>
<td>Able to construct process map</td>
<td>Process map completed</td>
</tr>
<tr>
<td>3/07</td>
<td>8/07</td>
<td>Resident education: mixed didactic slide lecture with role play</td>
<td>Receive weekly didactic lectures; active component to learning improves retention</td>
<td>HIV screening rates</td>
<td>Increased rates</td>
</tr>
<tr>
<td>3/07</td>
<td>10/07</td>
<td>Determine baseline testing rates</td>
<td>Understand current performance</td>
<td>Rates of hepatitis B virus, gestational diabetes, group B streptococcus, HIV screening</td>
<td>Known rates over 12 months</td>
</tr>
<tr>
<td>3/07</td>
<td>10/07</td>
<td>Attending education: informal individual conversations</td>
<td>Unaccustomed to formal interventions in clinical care</td>
<td>HIV screening rates</td>
<td>Increased rates</td>
</tr>
<tr>
<td>4/07</td>
<td>4/07</td>
<td>Nurse practitioner education: handout, modified consensus process</td>
<td>Hold regular small group meetings; accustomed to modified consensus process</td>
<td>HIV screening rates</td>
<td>Increased rates</td>
</tr>
<tr>
<td>10/07</td>
<td></td>
<td>Ongoing Audit and feedback</td>
<td>Knowledge of performance supports improvement efforts</td>
<td>HIV screening rates</td>
<td>Increased rates</td>
</tr>
</tbody>
</table>
signal of eight consecutive data points above the centre line was
achieved.

The educational intervention and audit and feedback process
proceeded on schedule with no major changes from the planned
intervention. The interventions were generally well received,
though buy-in varied, with two teams becoming very engaged
and two teams being only somewhat engaged. Very engaged
teams began their own process improvement initiatives for
prenatal testing and requested additional coaching. Somewhat
engaged teams participated but did not initiate their own
changes or request additional coaching.

No changes in the care process were planned as part of this
intervention. However, there was a change in the state law
during the intervention. This change eliminated a separate
consent form, and changed the consent standard from
‘informed consent’ to ‘consent’ for HIV testing as of October 2007.
The increased rates began after the educational intervention but
before the change in state law.

DISCUSSION
We have presented an integrated, multimodal approach to
significantly increasing prenatal HIV screening in an outpatient,
general ob/gyn setting. Our approach to this problem began with
work to develop a deep understanding of the local context, iden-
tifying a theoretical framework for project planning, and then
implementing tailored educational interventions combined with
team-level audit and feedback for sustainable improvement.

Mapping the process for ordering the four selected prenatal
tests led us to question the nature of the differences between the
tests. Glouberman and Zimmerman’s construct of the simple,
complicated and complex in healthcare, further elaborated by
Liu et al., fit with our documented clinic processes.10 11 Tests that
had the highest rates met the definition of simple processes; HIV
testing represents a complex process. Understanding the nature
of HIV testing and what made it different allowed us to proceed
with a multifaceted approach to change, matching the nature of
the problem to the nature of the intervention.

Limitations in this work include the inability to track the
effect of the change in consent documentation on the measured
outcome, as well as the anticipated lack of impact on patient
outcomes regarding HIV. Given low sero-prevalence, it is unclear
on a population level what the real impact of improved adher-
ence to the CDC guidelines will be. While the results have been
sustained over nearly a year, how well they will be sustained
further into the future is unknown. Finally, patients retain the
autonomy to opt-out of HIV screening, and rates at which
patients declined testing were not explicitly evaluated.

Sustainability was built in to this effort. In an academic
setting where care is provided by residents who change every
few years, long-term change must be implemented in robust
systems that withstand staff turnover. Routine data collection,
analysis and posting were made a part of the nurses’ duties, and
feedback to providers was performed monthly. Supervising
attending physicians oversee all care without the frequent
turnover of residents.

Practically, this intervention demonstrates an inexpensive way
to improve routine testing performance using evidence-based
improvement strategies in conjunction with an appropriate
conceptual framework. While HIV testing presents some unique
challenges, the general approach of process mapping, assessing
knowledge/attitudes/beliefs and implementing tailored educa-
tional interventions supported by audit and feedback applies to
many outpatient testing contexts. Although there is an extensive
literature documenting lower-than-desired prenatal HIV testing
rates in the USA and Canada, there is an apparent dearth of
practical approaches for remedying that on a clinical level. The

Key messages
- A deep understanding of the local context, coupled with
  a theoretical framework, was the basis for designing
  successful improvement interventions.
- Participatory educational interventions targeted to specific
  audiences and combined with audit and feedback produced
  a significant increase in our HIV testing rates.
- In our setting, HIV testing represented a complex process,
  requiring interventions that account for dynamic relationships
  and are flexible and multifaceted.
testing rates reported here, generally in the 95% range, are consistent with other reports and beg the question of reliable systems in healthcare. Amalberti et al outlined the current state of healthcare reliability and identified major barriers to highly reliable patient care systems. This work represents only the first step in improving reliability. The next step involves utilising a different set of tools, those needed to propel us from reliable to highly reliable, or from good to great.

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Competing interests None.

Provenance and peer review Commissioned; externally peer reviewed.

REFERENCES