Costs of Expanded HIV Testing in Four EDs: Results from HPTN 065

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BACKGROUND

- The Expanded HIV Testing component of HPTN065 sought to expand HIV testing in emergency departments (EDs) and inpatient units in 17 hospitals located in Washington, D.C. and Bronx, New York between 2011 and 2013
- Of the 17 hospitals participating in HPTN 065, four were selected to participate in the cost analysis because these hospitals sought to expand HIV testing among patients admitted to their EDs and recently switched from HIV point-of-care to rapid-result laboratory testing for some or all of their ED patients

METHODS

- Objective was to conduct cost analyses for ED laboratory HIV testing processes in place at each hospital as of January 2014 with the following outcomes:
  - Cost per patient tested
  - Cost per patient tested for an "optimized" ED HIV laboratory testing process
- Conducted micro-costing study to collect unit cost data (*Table 1*) and labor time
  - Interviews with hospital leadership and staff and process step observations
  - Hospital laboratory financial reports
- Mapped process flows for rapid-result laboratory testing in each ED
- Calculated cost per patient completing HIV test in 2013 US dollars
  - Included direct patient care costs (e.g., labor time, supplies, materials)
  - Costs reflect use of 3rd generation or 4th generation assays (see definitions in *Figure 1* below)
  - Excluded supervisory time and other overhead (e.g. occupancy) costs
- Calculated costs for optimized process flow and 4th generation assay
  - "Optimized" process flow based on the most efficient process step with the minimum time requirement observed for each step at any of the 4 hospitals, including the use of automated processes, and on using 4th generation assay

TABLE 1. LABOR AND MATERIALS UNIT COSTS

	Unit Cost	Source
Labor wage rate ($/hour)		
ED staff and laboratory personnel	14.05-74.36	1
Materials ($/unit)		
HIV Ab assay, 3rd generation – reagent plus control	4.00-7.89	Sites
HIV Ab plus antigen assay, 4th generation – reagent plus control	3.19-5.92	Sites
Western blot confirmatory test	26.60	2
Multispot confirmatory test	31.77	Sites
Latex, vinyl or nitrile gloves	0.12	3
Male condoms	0.06	3
Labels	0.01	Sites
Other (% of wage)		
Fringe	44.7	1

FIGURE 1: DEFINITIONS

- 3rd generation assay: a random-access chemiluminescent immunoassay (CIA) to detect IgM and IgG HIV antibodies; results in < 1 hour
- 4th generation assay: a random-access CIA combination p24 antigen-HIV antibody (Ag/Ab) assay to detect p24 antigen as well as IgM and IgG HIV antibodies; results in < 1 hour

RESULTS

TABLE 2. DESCRIPTION OF LABORATORY HIV TESTING PROCESS STEPS

Process step	Hospital A	Hospital B	Hospital C	Hospital D
Provide HIV test information	RN	integrated into registration process†	integrated into registration process†	integrated into registration process†
Confirm HIV screening eligibility	automated†	automated†	verbally from patient, counselor	verbally from patient, ED tech
Order HIV test	electronic, RN	electronic, registrar†	paper, counselor	electronic, ED tech
Collect specimen	RN/ED tech	phlebotomist†	phlebotomist†	ED tech
Process HIV test	lab tech	counselor	medical tech	lab tech†
Deliver and document non-reactive results	call-in center	discharge summary†	does not occur	ED tech
Deliver and document reactive results	counselor	counselor	counselor	physician & navigator†
Perform HIV confirmatory test	send-out/ Western blot	on-site/ Western blot	on-site/ Multispot†	on-site/ Multispot
Link to care	counselor	navigator†	navigator	navigator

†indicates the most efficient process step with the minimum time requirement for that step, included in the optimized process flow (Figure 2)

SUMMARY OF FINDINGS:

- Laboratory HIV Test Process Results (*Tables 2 and 3*)
  - Process step automation and staffing varied by hospital (*Table 2*)
  - Labor time estimates ranged from 7-25 minutes for non-reactive and 75-85 minutes for reactive HIV test results (*Table 3*)
- Laboratory HIV Test Costs (*Table 3*)
  - Costs ranged from $17-$24 per HIV non-reactive test
  - Costs ranged from $89-$110 per HIV reactive test (including confirmatory testing and initial linkage to HIV care activities)
- Optimized Process Flow Steps and Costs (*Figure 2 and Table 3*)
  - 3 process steps automated (*Figure 2*)
  - Automating these process steps reduced the labor time required to complete the testing process resulting in (*Table 3*):
    - 45% lower costs for non-reactive HIV test results
    - 20% lower costs for reactive HIV test results
- Optimized Process Flow Sensitivity Analysis (*results not shown*)
  - Substituting lowest cost personnel and materials among the 4 hospitals for the actual costs incurred by hospitals with the minimum process time did not substantially lower the cost of the optimized process

FIGURE 2: OPTIMIZED RAPID-RESULT LABORATORY HIV TESTING PROCESS FLOW

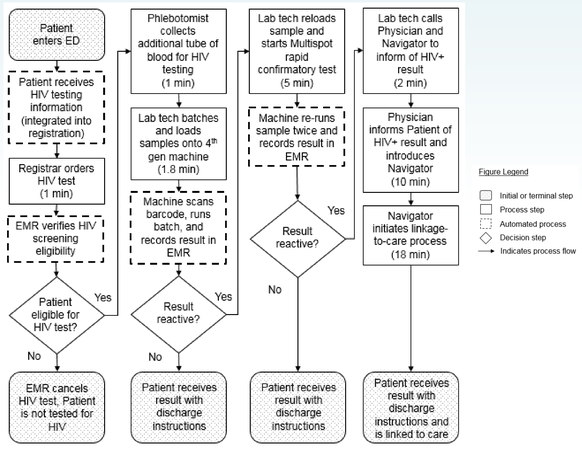

TABLE 3. LABORATORY HIV TESTING TIME ESTIMATES AND COSTS

	Observed Labor Time Estimates Across 4 EDs (min)	Observed Cost Across 4 EDs ($)	Optimized Process Cost ($)
Total (per patient completing HIV test)			
HIV non-reactive result	**6.5-24.8**	**17.00-23.83**	**11.05**
HIV reactive result	**75.3-84.8**	**89.29-109.52**	**82.61**
Labor (per process step)			
Provide HIV test information††	0.0-1.0	0.00-0.82	0.00
Confirm HIV screening eligibility	0.0-16.0	0.00-9.21	0.00
Order HIV test	1.0-4.9	0.34-2.80	0.34
Collect specimen	1.0-5.4	0.35-1.91	0.35
Process HIV test§	0.5-5.3	1.24-1.29	1.24
Document results (non-reactive)	0.0-0.4	0.00-0.59	0.00
Deliver results (non-reactive)	0.0-2.0	0.00-1.49	0.00
Document and deliver results (reactive)	13.0-38.5	17.13-22.44	17.13
Perform HIV confirmatory testing§§	5.0-32.0	3.36-19.20	3.36
Link to care	18.0-26.0	10.36-16.30	10.36
Materials (per unit)			
HIV testing§	N/A	9.12-9.59	9.12
HIV confirmatory testing§§	N/A	40.71-41.29	40.71
Link to care	N/A	0.00-0.36	0.00

N/A = not applicable; †if cost equals zero, step was automated with no incremental cost; ††only one site had a cost for completing this step; at all other sites this step was integrated into the registration process with no additional labor time required; §4th generation laboratory testing only; §§Multispot confirmatory test only

LIMITATIONS

- These 4 hospitals are not representative of all 17 hospitals participating in HPTN065
- Costs exclude "down time," supervisory time, and other overhead costs
  - Therefore, these cost estimates are lower than the total costs to hospitals
- Costs to implement "optimized" process flow require initial investments, for example:
  - 300+ hours of programmer and project management time to create electronic medical record interface
  - 1 day of in-person training plus additional time to train other laboratory staff on 4th generation laboratory equipment for hospitals currently using 3rd generation assays

CONCLUSIONS

- Cost of HIV testing varied substantially among the 4 hospitals
- Optimizing process flows could reduce costs by ~45% for non-reactive results, which are the vast majority of tests performed
- These observations provide a basis for designing initiatives to optimize HIV laboratory testing processes in EDs
- Policy makers and hospital leaders should seek to further automate HIV testing processes using electronic system interfaces

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