Online supplement to:

Screening Healthcare Workers with IGRA vs. TST: Impact on Costs and Adherence to Testing (the SWITCH study)

This supplement shows the material and labour costs at our institution and the results of the time-motion study for annual screens and new hires which together result in the cost inputs that go into the model (collated in Tables 1a and 1b) and gives a description of the structure of the decision tree model used in the cost analysis showing the cost and probability inputs to each decision-trees (Figures 1a-e). Note that Tables 1a and 1b in this online supplement and the main manuscript are identical. They are reproduced here for ease of reference.

Table 2 shows the results of the patient questionnaires administered to all study participants. Tables 3a-d shows the modeled scenarios where total costs of screening using the TST and T-SPOT are calculated using different model constructions to reflect different policies for conducting screening.

Material & Labor Costs

Material costs were taken from institutional records and calculated on an as consumed basis (that is, accounting for wastage that occurs). The costs for the TST was calculated at $2.83 which includes the cost of PPD and the cost of the needle and syringe for administering the PPD. No IGRA cost was inputted as this value was an output of the model. The value for IGRA was sought at which the total costs of screening using the IGRA equated to the total costs of screening using the TST (that is, the value at which the IGRA starts to become cost saving versus the TST). In each case a $0.11 provision was made to the IGRA cost for phlebotomy supplies. No test costs were associated with samples not yielding a valid IGRA result, consistent with ODL's policy not to charge for invalid or unusable samples.

Labor costs were sought for the persons administering the TST program (employee health staff) and for those undergoing testing (the whole of our workforce that may encounter patients). Our employee health program has three grades of employee involved in the TB screening process; registered nurses, technicians and administrative staff for inputting data and managing records. Their hourly wage cost to the institution (including benefits) is shown in Table 1a & 1b. For those undergoing testing, we sought to compute an average labor cost of all employees. This process was simplified by seeking from our HR

department the numbers of staff and hourly wage costs to the institution for 10 different job classifications. The average labor cost was calculated as a weighted-average of these figures (that is, accounting for the fact that we have more staff in some of the different classifications than others). Table 1a & 1b shows the hourly rates for each of the 10 classifications and their percentage of our staff, which results in a weighted-average labor cost for employees undergoing testing of $49.38/hour.

The summary of all material & labor costs are shown under the heading 'Material and labor cost inputs' in Table 1a & 1b. These costs do not vary whether annual screens or new hires are being tested and hence are the same for both Table 1a and 1b.

Time-Motion Results

The results of the time-motion study are shown under the heading 'Time-motion outputs' in Table 1a (for annual screens) and Table 1b (for new hires) respectively. During each of the 393 patient encounters we followed, the time consumed by both the employee health staff (administering the task) and by the employees (travelling, waiting in line, undergoing the appointment) were measured. Results are shown as the average times in minutes taken for each step, rounded to the nearest decimal place and then computed into a labor cost. For employee health staff tasks this labor cost reflects the grade of person who would perform this task (e.g. technicians for phlebotomy, nurses for an chemoprophylaxis consult, administration for data entry). For calculating the cost of employee time off work, the weighted-average labor costs as previously calculated was used.

At our institution, we have over 200 personnel trained to administer and/or read TST results so that we can conduct annual screening for a significant proportion of our employees at a location convenient to them (e.g. adjacent to the central cafeteria or at their unit) rather than requiring them all to travel to the employee health department. As would be expected, the travel and wait time for employees is higher when attending visit appointments at a remote location (the employee health department) than when attending screening locally. When calculating the employee time-off-work costs for TST placement and reading, we modeled 42% of our annual screening tests taking place at a locally and 58% taking place at the employee health department. We know these to be accurate percentages as the location of our screens is recorded. Although it might be more practical to have IGRAs administered locally (as phlebotomy availability is ubiquitous in our hospital), we assumed for consistency that, as with the TST, there was a 42:58 split in where tests were done.

For new hires, all screens are performed at the employee health department, although the first step of two-step testing does not incur any employee time off work costs for the institution as recruits receive the first step prior to becoming an employee. Therefore employee time off work costs are only consumed for new hires when associated with their second test. Similarly, in the IGRA model there are no employee time off work costs associated with the IGRA as all patients must have a valid baseline set in order to start work (and there is no second-step with the IGRA after they have joined). For the same reasons compliance to the first-step of the TST and to the IGRA is always 100%, as by definition if recruits do not complete this step, they do not start working. Our treatment of persons with positive results following screening is also somewhat different for new hires than for annual screens. Whilst the latter are dealt with firstly by employee health, new potential recruits who are not yet employees are referred to the local public health department as the first step (after which they require a clearance to work consultation). This slightly alters the costs associated with follow-up and any treatment that results from a newly positive test between annual screens and new hires.
The employee health time/cost associated with placing the first step TST ($1.51) or of T-SPOT phlebotomy ($0.90) in new hires are less than the corresponding costs for annual screens ($4.91 and $3.02 respectively), as with annual screens the whole appointment is only for TB screening, whereas for new hires, the TB testing is conducted as part of an appointment covering history taking and other tests (e.g. collection of blood for antibody titers). Consequently the 'frictional' costs of the appointment (for example, finding the patients records, collection and disposal of relevant supplies, returning the patient's records, venepuncture procedure) are shared over more tasks making the cost attributable to the TB component lower. Additionally, there is a difference in the labor rates of persons performing TB screening at employee health (more cheaper technicians are used as we can supervise their work more closely) than in annual screens where the testing is done outside of employee health (where primarily nurses are used as they do not have access to close supervision). For the same reasons, as the appointments to read the TST for new hires and place the second step TST are appointments that are not shared with other activities, they are consequently more expensive to perform.

Due to their irregularity, we were not able to measure the time taken for three rare events, writing a chest X-ray requisition for an employee who needs to attend the outpatient department to receive a chest X-ray as follow-up from initial screening, the employee time off work to undergo this, and the time taken for an INH consultation post the chest X-ray. These were estimated by employee health staff as taking 5, 45 and 25 minutes

respectively, and these figures were used in the analysis. We attempted to calculate the costs associated with the rare occurrences of TST adverse reactions. Our questionnaire data showed that amongst 601 persons without a known prior positive TST (those with a known prior positive would not be at risk of an adverse reaction as they would not be receiving another TST), 36 self-reported an adverse reaction to the TST of which 6 (1%) were self-reported as severe. Based on this data, our assumption was that 1% of TSTs placed in annual screens resulted in an adverse reaction that resulted, on average, in 2 hours off work having the reaction investigated/treated. Our assumption for new hires was that adverse events severe enough to require any kind of medical treatment would typically result at the first step, that is before the person actually begins work. Consequently we did not attribute any cost to adverse events for new hires.

As part of the time-motion study, we also examined the time consumed in following-up TST non-returners in order to get them to recomplete screening (such as telephone and e-mail reminders of appointments). It is self-evident that the more time spent following-up, the greater the success rate there is of employees undergoing retesting. Consequently our time-motion investigation, as well as measuring the time consumed, measured the success rate of completion of screening. These two variables are inextricably linked and consequently the success rate of completion (a probability used in the decision-trees) must reflect the time spent following-up. As discussed in the main body of the paper, we chose to model two possibilities at either end of the effort spectrum; following-up such that 95% of non-returners actually complete screening (which our time-motion investigation showed would require 10 minutes of employee health time to be consumed per initial non-returner), our base case, or not following-up at all (0 minutes of employee health staff time consumed). The results for this latter scenario are shown in Table 3a of this supplement.

From these constituent costs, we derived a number of cost subtotals to allow for easier inputs into the decisions trees. These are also shown in Tables 1a and 1b under the heading ‘Derived costs subtotals’ with an explanation of the individual constituents of each subtotal.

The CDC recommends that all those personnel who place or read TSTs receive annual retaining [1]. We have 215 trained placers and readers at our institution in addition to the 15 employee health staff who perform TST screening as a core part of their duties. TST placement/reading training consists of a 4 hour course performed at an offsite location. The costs of retraining these personnel was calculated as the sum of course costs and the

employee time off work (4 hours of the course plus 1 hour return travel time). We also included a provision for labor turnover which requires us to train new personnel to replace those who have left during the year.

This retraining cost is a fixed cost which was translated into per person cost by dividing the total cost by the retraining by the numbers of persons screened. Clearly this fixed cost is lower for new hires (as all testing is done by a smaller number of persons engaged with TST as a major part of their role) than for annual screens, where we have 215 persons trained to placed and read TSTs who require retraining for a just a few days of screening each per year. The total costs for annual retraining associated with those screening annual hires is $83,102, or $7.26 per person when divided over 11,454 annual screens (screening numbers taken from our annual statistics Jul 2009-Jun 2010). The total costs for annual retraining associated with those screening new hires is $5,666, or $0.90 per person when divided over 6,359 annual screens. This is reflected in the fixed costs shown at the bottom of the decision-tree output tables in Figures 1a & d. Clearly, with an IGRA the need for annual retraining of TST placers/readers is removed and with it the fixed costs of doing so.

Decision-trees

Five separate decision-trees were constructed as part of our analysis, two for the TST reflecting the screening pathways for annual screens and new hires (Figure 1a and Figure 1d respectively) and three for the IGRA test reflecting the screening pathways for annual screens (Figures 1b&c) and new hires (Figure 1e). The two annual screening models with IGRA allow us to reflect the different situations that could result (depending on institutional policy) in the first year of adopting an IGRA (where all people might be tested regardless of prior TST result) from subsequent years where people with a prior known positive IGRA result would not be retested. The decision-trees themselves, their inputs (both costs and probabilities) and outputs (cost of each pathway, probability weighting attached to each pathway, probability adjusted cost and total cost) are also shown in Figures 1a-e.

The decision-tree in Figure 1a starts with an employee attending annual screening (purple decision node). All those with an eligible prior positive TST result are excluded from receiving a further TST and instead are administered a symptom screen. Their screening is now finished and they sit in end state 1. All others have a TST placed (blue decision node), most of which have the test read and proceed to the yellow node. For those who

fail to get the test read, our decision-tree model then allows for these people to be followed-up by employee health staff to get them to return and complete screening (green node). Those that do complete screening after follow-up, then proceed to the yellow node where their test result is treated as per employees who did return first time around. Those that fail to return after follow-up finish in end state 2 where their screening is incomplete. Returning to those who do have a valid TST result (yellow node), this result can be positive or negative, from which a determination is made over whether this is a conversion or not. If not then these people have completed screening and finish in end state 3. Otherwise those who are deemed a conversion have a chest X-ray after which they are either indicated for chemoprophylaxis or not, which they either accept or not. Our decision-trees do not allow for the possibility that the chest X-ray identifies active pulmonary TB as modeling the costs of active TB is excluded from the model. In practice, this is such a rare occurrence (we have had only 1 case of active TB discovered during new hire and annual surveillance over the past 20 years) that excluding it does not have a material impact on the model. We also exclude the possibility that a test conversion triggers a wider investigation of a ward or unit searching for a hitherto unknown index case of active TB and the ensuing contact investigation. Again, to identify a cluster of conversions in annual screening that prompts a retrospective contact investigation is a rare occurrence.

The input probabilities for the TST models (Figures 1a and 1d) were taken from our annual TB testing records (statistics for the year Jul 2009-Jun 2010 were used for this purpose). Taking the annual screen model first. In our institution, 10.1% of our employees have a documented prior positive (1,152 from 11,454 annual screens) making the probability p1=0.101. 20% of our annual screens in whom TSTs are placed do not attend to have the test read either at all, or within the requisite 48-72 hours, hence p2=0.20. p3 is the probability that people still do not complete screening after follow-up. We have chosen to model the situation where people are followed-up such that 95% of non-returners successfully complete rescreening, hence p3=0.05. The p3 value is inextricably linked to the assumption over the follow-up time consumed (the ‘follow-up of TST non-returns’ entry in the top right hand side box in Table 1a). We also model a scenario where no follow-up is performed on non-returners. In that scenario, the ‘follow-up of TST non-returns’ entry is zero and p3=1. Our TST conversion rate for annual screens was 0.24% (25 conversions amongst 10,302 annual screens without a known prior TST positive) in the period Jul 2009-Jun2010, hence p4=0.9976. We performed chemoprophylaxis (INH) consultations with 67 persons over the July 2009-Jun 2010

period. It was determined that 59 (88%) were eligible for chemoprophylaxis (hence p5=0.12). Of those 59 eligible, only 7 (12%) accepted chemoprophylaxis, hence p6=0.12.

Taking the new hire model, we estimated based on our experience that 1% of new recruits have a valid prior TST (hence p1=0.01). For us to consider a prior TST result valid, the individual needs to bring in proof that a test was conducted within the last 12 months and documentation of the result. Our non-return rate for new hires regarding their second step averages 50%, hence we set p2=0.5. p3 is 0.05 for the same reasons as in the annual screen model. In the year Jul 2009-Jun 2010 we had 507 positives from 6,359 new hires screened making the probability (1-p4)=0.08. However, the vast majority of these (429, or 84.6%) reported a prior history of a TST positive and consequently our policy is not to refer these to chest X-ray and offer chemoprophylaxis. The chemoprophylaxis eligibility and acceptance rates are as for the annual screen model.

Figures 1b & 1c respectively, show the corresponding decision-trees for an IGRA in annual screening in the year of the switch (year 1) and subsequent years. These two decision-trees differ slightly in that in the year of the switch, we are assuming that everybody will be retested regardless of whether they have a prior positive TST or not, so as to set a new baseline. In subsequent years, those with a prior positive IGRA result will not be retested as per current policy with the TST. Both to ensure consistency with the corresponding TST model, and to reflect current CDC guidance, the decision-tree in Figure 1c was used as the default for the cost calculations. In both decision-trees, after an initial blood draw is taken, a determinate (positive, negative, borderline) result can be obtained, or a retest is indicated (for example, from an invalid test result, sample processing error or failure of initial phlebotomy). The decision-trees allow for the costs of retests to be captured and those with valid results on retesting (in our experience the vast majority) to proceed with screening. If the test is positive then we allow for the possibility that not all IGRA positives are necessarily considered a conversion. This would occur, for example, if in the first year of the switch, we obtained a positive IGRA result in someone who was previously TST positive. We are not considering this a conversion. In subsequent years, our base assumption is that all IGRA negative to positive changes are considered a conversion (p5=0). We have condensed the INH eligibility/acceptance probabilities from the TST decision-trees into one probability in the IGRA decision-tree for brevity. Our assumption is that the same number of people are both eligible and accept INH after a positive IGRA as a positive TST. This assumption seems reasonable, although some commentators have suggested that patients may more

readily accept the validity of the IGRA results and this might therefore improve IGRA acceptance rates [2].

The probabilities for the IGRA 1st year model (Figure 1b) were derived as follows. The probability of a retest being required was taken from our study cohort of 473 annual screens where 2 did not obtain determinate T-SPOT.*TB* results, hence p1=0.0042. As with the TST models, p2=0.05 as our base case is that follow-up is conducted such that 95% of those without an initial result are successfully rescreened. Turning to p3, in this first year case where everybody including known prior TST positives are retested, IGRA positives will come from two sources: known TST positives confirmed with IGRA and those with previously negative or unknown TST results who are now positive with IGRA. Taking the first subgroup, from our study results, of the 113 known prior TST positives tested, 34 were also positive with T-SPOT.*TB* (30.0%). Therefore, given our yearly total of 1,152 known TST positives in annual screens, then we would expect the IGRA to be positive in 30%x1,152 = 347 of these persons. In our study there were 312 people without a known prior positive TST result, and in whom we had both an IGRA and TST result to compare. Of these 312, there were 10 positives by T-SPOT.*TB* and 6 positives by TST. Hence, amongst our yearly total of 25 new TST positives (0.24%) then the positive rate with an IGRA would be expected to be 10/6 x 25 = 42. Combining both of these, we therefore would expect that (347+42)/11,454, or 3.4% of T-SPOT results would be positive in the first year of testing. Consequently, p3=0.966. Clearly, not all these positives would be treated, as of the 389 positives, 347 come from re-confirming by IGRA people who were previously known TST positives. There is no rationale to consider these people true conversions (i.e. having been newly infected during the year) and consequently our model assumes that these people would not be sent for chest X-ray or offered INH. Hence p4=0.89 (347/389). As previously mentioned, our assumption over INH eligibility and acceptance is as per the TST, hence p5=0.09 (7 acceptances from 67 INH consults).

Figure 1c shows the probability assumptions for the IGRA decision-tree applied in year 2 and beyond after switching to an IGRA. Unlike the TST, there is no contraindication to re-administering IGRAs on those with prior positive results, and there may be value in this approach, but our assumption was that an IGRA would not be repeated in persons with prior positive IGRA results. Our prior positivity rate with the TST was 10.1% for all our annual screens in the year Jul 2009-Jun 2010. We estimated the equivalent prior positivity rate for the IGRA by scaling from the relative positivity rate of T-SPOT.*TB* in our parallel testing study where there were 34 T-SPOT.*TB* positives amongst our 113

known prior TST positives. Hence our assumption for p1 was 34/113 X 0.101 = 0.03. p2 and p3 are as per the 1st year model. As discussed at length in the main manuscript, we made the subsequent assumption that the conversion rate of T-SPOT.*TB* (that is, the positivity rate in those who had a negative prior T-SPOT.*TB* test result) would be the same as the TST at 0.24% (hence p4=0.9976). Although we left open the possibility to model a scenario that not all negative to positive IGRA movements would be considered a conversion, our base assumption was that they would all be treated as such, hence p5=0. p6 is as per the 1st year model.

Figure 1e shows the IGRA decision-tree for new hires. Our assumption is that an employee is highly unlikely to present with a recent documented IGRA results at their new hire appointment, and consequently we assume p1 to zero. The probability of a retest being required was taken from our study cohort of 270 new hires tested with T-SPOT.*TB* from which 1 did not yield determinate results, hence p1=0.4%. p3 is necessarily zero as only new recruits with a valid baseline TB test can become an employee. We have previously discussed that in the year Jul 2009-Jun 2010 we had 507 TST positives from 6,359 new hires screened making the TST positivity rate in new hires 8.0%. We estimated the equivalent probability of a positive IGRA results from our parallel testing results in which there were 23 T-SPOT.*TB* positives compared to 39 TST positives (either new or self-reported) in new hires. Hence (1-p4)=23/39 X 0.08 = 0.05. The INH eligibility and acceptance rates are as per the TST.

All the decision-trees in Figures 1a-e are accompanied by two tables. The left-hand table shows the probability inputs (as discussed above) and cost inputs to the decision-tree. The cost inputs are just a restatement of the 'derived cost subtotals' already reported in Table 1a & 1b; however to reduce confusion, only those relating to that decision-tree are shown (for example, a TST decision-tree will not refer to IGRA costs and vice versa).

The right-hand table above each decision-tree in Figures 1a-e show the costs associated with each pathway and probability that each pathway in the decision-tree is taken based on the probability inputs. There are, in some cases, two pathways that could be taken to get to the same end-point. For example, a person could complete screening in end state 3 via the bottom pathway (from an initially negative test) or the top pathway (from a negative retest after follow-up). The total cost of each pathway (cost of going through pathway multiplied by the probability of going through that pathway) are summed to give the total per person costs of screening in that decision-tree. In the case of the TST tables, there is an additional row to this table showing the additional per person fixed costs that

must be added to the variable costs of the TST to account for the annual retraining of TST placers and readers.

Adherence rates (compliance) is reflected in the probability that a person entering the decision-tree finishes in a pathway that is consistent with completion of screening. In each decision-tree there is an end state labeled ‘Screening incomplete TB status unconfirmed’ that captures all those who do not complete screening. A limitation of all the decision-tree models is that they do not allow for the possibility that people will not be compliant with screening by not even attending for initial TST placement/IGRA phlebotomy. However, in practice the initiation of screening is usually enforced through administrative controls; for example, at our institution new hires cannot start work unless they have at least completed the first step of their two-step testing. In the case of two-step testing of new hires using the TST, there are some other non-compliance possibilities; for example, a potential recruit could have their first-step TST placed, but not return for reading. Clearly they would not be allowed to start work in this instance, but it would still consume employee health resources. This occurrence is sufficiently rare that we have excluded this from our model. The second possibility is that a new hire would complete their first-step TST, attend for placement of their second-step TST but not return for its reading. Our model, for simplicity, assumes that if new hires are non-compliant, they do not attend for the second step placement. This assumption favors the TST, as if non-compliance is manifest instead as non-return for reading of a place second-step, then additional resources will have been consumed for both employee and employee health in the placement of the second step that does not get read.

Sensitivity analysis

Each of the five decision-tree models contains 48 model inputs which fall into six categories: the hourly cost of a general employee, the time consumed for the employee in various TB screening procedures (which together translate into the cost of time off work to attend screening), the hourly cost of various employee health staff members, the time consumed for the employee health staff in conducting various TB screening procedures (which together translate into the salary costs of those performing the screening), input probabilities of the models (which relate to test positivity of TST and IGRA and the behavior and epidemiology of our employees) and lastly the direct materials costs consumed in TB screening and follow-up. The labor costs, materials costs and times are shown in Tables 1a and 1b and the input probabilities for each of the decision tree are shown in Figures 1a-e.

To account for errors in our point measurements of input probabilities and costs arising from our time motion and TST/IGRA sample data, as well as to generalize the model outcomes for other institutions with different costs, a sensitivity analysis was performed by varying all 48 model inputs by a fixed value of ±20% the base amount to show those variables that most impact the model outcomes. In relation to the probabilities, the lower of each paired probability (i.e. p1 and (1-p1)) was varied to avoid the variation causing probabilities to exceed 1. All inputs were varied independently, for the purposes of this sensitivity analysis any dependence between inputs was ignored.

In addition to the sensitivity analysis, we also constructed models to model different testing scenarios. One of these was to model the costs and adherence rates should no follow-up be performed to ensure that initial non-returners actually complete screening. To effect this, the following changes were made to the base model. Firstly the employee health staff time attributed to follow-up of TST non-returns was set to zero (previously 10 minutes) in both the annual screen and new hire models. For each of the decision trees, p3 was set to 1, to reflect that none of those who didn't complete TST would come back for screening, likewise for those who did not obtain an IGRA result first time around (e.g. due to an invalid result). The only exception to this was the IGRA new hire model, where compliance is 100% by default, as without a valid IGRA result, they cannot become employees. This compares to the TST, where they must have their first step placed to become an employee, but may default in the placement and reading of the 2^{nd} step.

The second and third scenario modeled was to examine the effects of conducting all (both TST and IGRA) annual screening locally versus all annual screening remotely. This compares to the base case where, in our institution, 42% of annual screens are performed locally and 58% remotely at the employee health building. For the remote (e.g. at employee health building) screening model, we made the following adjustments to the base model. First, the calculation of the time off work for employees to attend screening was adjusted to reflect the fact that now all consultations would take place at a remote location. This increase in cost is somewhat mitigated by a change to the assumption over the fixed costs of training TST placers and readers as there is now no need for the initial and annual retraining of the 215 dispersed staff for reading TSTs locally. Consequently, the costs of training the 215 were removed and instead replaced with an assumption over the per test cost attribution of TST training of full-time employee health staff taken from the new hire model (where all screening already takes place at the employee health department). The fact that all screening takes places at the employee health department

also means that cheaper technicians can be used for TST placement and reading. The changes made to the base model to show the effects of conducting screening all locally were the opposite to those already described. Employee health time off work to attend screening is reduced to reflect the fact that all consultations are local, but more nurse time (and more training of TST placers/readers) is required to be able to screen greater numbers away from the employee health department. In the absence of any data to the contrary, we assumed that the compliance of healthcare workers did not change in either scenario. We also assumed that the time and success associated with follow-up of non-returners did not differ between these cases.

The fourth scenario modeled was that all borderline T-SPOT.*TB* results would be retested, where we made the following adjustments to the base model. In the annual screen part of the model, p2 for the IGRA was changed to reflect the fact that borderline results were no longer considered actionable results and required retesting. Our parallel testing results (Table 1 of the main manuscript) show that there were 8 borderline results, in addition to the 2 no results, hence 10/473 (2.1%) of results would require retesting. The corresponding value for the new hire model is 2.6% (7/270). We also made provision for the extra IGRA costs associated with a second chargeable IGRA test caused by retesting initially borderline samples.

References

[1] Centers for Disease Control and Prevention. Guidelines for preventing the transmission of Mycobacterium Tuberculosis in Health-Care settings, 2005. MMWR 2005;54 (No.RR-17)

[2] Grinsdale J, Ho C, Banouvong H, Kawamura L, Programmatic impact of using QuantiFERON-TB Gold in routine contact investigation activities. Int J Tuberc Lung Dis 15(12):1614–1619. 2011

Tables

Table 1a & b. Cost inputs for annual screen and new hire model

This table shows the model inputs in terms of materials costs, labor costs for employee health staff administering elements of the screening program, the average labor rate for employees undergoing screening and the times (and hence costs) taken to complete various elements of a TB screening program from both employee health and employee perspective. These cost subcomponents are then combined to calculate the costs of various steps of the TB screening procedure (e.g. TST placement). These derived costs are shown in the 'Derived Cost subtotals' section. An explanation as to how the cost for each of these is derived from the aforementioned cost inputs is shown alongside each one.

Material & Labour cost inputs

Material costs ($)

TST	$2.83
T-SPOT	Model output
Chest X-ray	$51.00
INH Treatment	
INH drug costs	$14.28
Liver function tests (x9)	$16.92
Subtotal	$31.20

Employee health labor costs ($/hour)

Nurse	$54.44
Technician	$24.43
Administrative	$20.94

Employee labor costs ($/hour)

Classification	*$/hour*	*% of workforce*	*Weighted cost*
1.Physician	$110.52	16%	$17.58
2. Clinical Services	$34.65	36%	$12.58
3. Management	$139.04	6%	$8.76
4. Administrative services	$27.91	5%	$1.40
5. Support services	$21.02	13%	$2.81
6. Finance	$39.46	1%	$0.28
7. Human Resources	$40.11	0%	$0.17
8. IT	$47.06	3%	$1.37
9. Student	$12.90	8%	$1.06
10. Other	$31.03	11%	$3.37
		Total weighted-average employee labor cost ($/hour)	$49.38

Time-motion outputs

Employee health staff time

Procedure	*Time (mins)*	*Cost ($)*
Symptom Screen	5.0	$4.49
TST Placement	7.5	$4.91
TST Reading	6.7	$6.05
T-SPOT phlebotomy	7.4	$3.02
Follow-up of TST non-returns	10.0	$5.32
Data entry of TB screens	6.2	$2.16
Reviewing TST Positive	13.7	$12.43
CXR test requisition	5.0	$4.54
INH consultation	25.0	$22.68

Employee time off work

Procedure	*Time (mins)*	*Cost ($)*
Consultation at remote location	33.2	$27.30
Consultation locally	5.6	$4.61
Undergo Chest X-ray	45.0	$37.04
Cost of TST adverse reaction	see notes[1]	$0.99
TST Placement	22.9	$18.84
TST Reading	22.3	$18.32
T-SPOT phlebotomy	23.6	$19.46

Notes

1. 1% rate of adverse events each requiring 2 hours off work

Derived cost subtotals

Procedure	*Cost*	*Explanation of cost subcomponents*
Cost of TST (placement & reading)	$54.09	EH staff time to place the test + Employee time off to attend placement (travel & wait + appointment duration) +TST Material Cost + EH staff time to read + Employee time off to attend read (travel & wait + appointment duration) + EH staff time for data entry of results + Employee time off for adverse reactions.
Cost of TST (placement & reading for chased up initial non-returner)	$88.15	Failed test[EH staff time to place the test + Employee time off to attend placement (travel & wait + appointment duration) +TST Material Cost + EH staff time for data entry of results]+Follow-up[EH staff time spent chasing]+Cost of repeat test[EH staff time to place the test + Employee time off to attend placement (travel & wait + appointment duration) +TST Material Cost + EH staff time to read + Employee time off to attend read (travel & wait + appointment duration) + EH staff time for data entry of results] + Employee time off for adverse reactions.
Cost of TST (non-return)	$35.04	Failed test[EH staff time to place the test + Employee time off to attend placement (travel & wait + appointment duration)+TST Material Cost + EH staff time for data entry of results]+Follow-up[EH staff time spent chasing] + Employee time off for adverse reactions.
Cost of Determinate T-SPOT test	$79.57	EH staff time to draw blood + Employee time off to attend phlebotomy (travel & wait + appointment duration) +Cost of T-SPOT test + EH staff time for data entry of results.
Cost of Determinate T-SPOT test (after repeat test)	$106.87	Not applicable in base model as no follow-up of T-SPOT non-returns is modelled. Failed test[EH staff time to draw blood + Employee time off to attend phlebotomy (travel & wait + appointment duration) + EH staff time for data entry of results] +Follow-up[EH staff time to chase each completer down]+ Cost of repeat test[EH staff time to draw blood + Employee time off to attend phlebotomy
Cost of T-SPOT (unable to get a result)	$27.30	Failed test[EH staff time to draw blood + Employee time off to attend phlebotomy (travel & wait + appointment duration)] + Follow-up[EH staff time spent chasing] + EH staff time for data entry of results.
T-SPOT Positive consultation (no CXR indicated)	$4.54	Situation where T-SPOT is positive in an annual screen, but deemed not to be a conversion (no CXR indicated). Costs are on top of T-SPOT result costs above.
Cost of symptom screen	$15.33	EH time to perform symptom screen + Employee time to attend screening (travel & wait +duration time) + EH staff time for data entry .
Cost of INH Treatment	$317.30	Drug costs + 9 LFTs + EH staff time for 9 consults + Employee time for 9 EH visits.
Cost of CXR using TST	$127.69	EH staff time for test positive consultation + EH staff time to write up CXR Requisition + Cost of CXR itself + Employee time off work to receive CXR + EH staff time for CXR review, INH consultation & issuance of clearance to work
Cost of CXR using T-SPOT	$115.26	EH staff time for CXR Requisition + Cost of CXR itself + Employee time off work to receive CXR + EH staff time for CXR review, INH consultation & issuance of clearance to work .

Table 1a. Cost inputs for annual screen model

Material & Labour cost inputs

Material costs ($)

TST	$2.83
T-SPOT	Model output
Chest X-ray	$51.00
INH Treatment	
INH drug costs	$14.28
Liver function tests (x9)	$16.92
Subtotal	$31.20

Employee health labor costs ($/hour)

Nurse	$54.44
Technician	$24.43
Administrative	$20.94

Employee labor costs ($/hour)

Classification	*$/hour*	*% of workforce*	*Weighted cost*
1.Physician	$110.52	16%	$17.58
2. Clinical Services	$34.65	36%	$12.58
3. Management	$139.04	6%	$8.76
4. Administrative services	$27.91	5%	$1.40
5. Support services	$21.02	13%	$2.81
6. Finance	$39.46	1%	$0.28
7. Human Resources	$40.11	0%	$0.17
8. IT	$47.06	3%	$1.37
9. Student	$12.90	8%	$1.06
10. Other	$31.03	11%	$3.37
		Total weighted-average employee labor cost ($/hour)	$49.38

Time-motion outputs

Employee health staff time

Procedure	*Time (mins)*	*Cost ($)*
Symptom Screen	5.0	$4.49
TST Placement (1st step)	2.3	$1.51
TST Placement (2nd step)	7.5	$4.91
TST Reading	6.7	$4.38
T-SPOT phlebotomy	2.2	$0.90
Follow-up of TST non-returns	10.0	$5.32
Data entry of TB screens	6.2	$2.16
Reviewing new TST Positive	13.7	$12.43
CXR test requisition	5.0	$4.54
INH consultation	25.0	$22.68
Clearance to work appointment	15.0	$13.61

Employee time off work

Procedure	*Time (mins)*	*Cost ($)*
Consultation at EH bldg	33.2	$27.30
TST Placement (2nd Step or retest)	34.5	$28.37
TST Read (2nd step or retest)	33.8	$27.85

Derived cost subtotals

Procedure	*Cost*	*Explanation of cost subcomponents*
Cost of TST (placement & reading)	$81.38	1st step[EH staff time to place the 1st test + TST Material Cost + EH staff time to read 1st test + EH staff time for data entry of results of 1st test] + 2nd step[EH staff time to place the 2nd test + Employee time off work to attend 2nd test placement (travel & wait plus appointment duration) +TST Material Cost + EH staff time to read 2nd test + Employee time off work to attend read 2nd test(travel & wait + appointment duration) + EH staff time for data entry of results of 2nd test] + Employee time off for adverse reactions.
Cost of TST (placement & reading for chased up initial non-returner)	$86.70	1st step[EH staff time to place the 1st step + TST Material Cost + EH staff time to read 1st step + EH staff time for data entry of results] + Follow-up[EH staff time spent chasing]+Cost of doing 2nd step[EH staff time to place the 2nd step + Employee time off to attend 2nd step placement (travel & wait plus appointment duration) +TST Material Cost + EH staff time to read 2nd step + Employee time off to attend read 2nd step(travel & wait + appointment duration) + EH staff time for data entry of results + Employee time off for adverse reactions. Excludes confirmation reading of a positive TST (included in Cost of CXR below)
Cost of TST (non-return) (completion of 1st step only)	$16.20	1st step[EH staff time to place the 1st step + TST Material Cost + EH staff time to read 1st step + EH staff time for data entry of results] + Follow-up[EH staff time spent chasing]
Cost of Determinate T-SPOT test	$57.99	EH staff time to draw blood +Cost of T-SPOT test + EH staff time for data entry of results.
Cost of Determinate T-SPOT test (after repeat test)	$61.01	Failed test[EH staff time to draw blood] + Completed test[EH staff time to draw blood + Cost of T-SPOT test] + EH staff time for data entry of results.
Cost of T-SPOT (unable to get a result)	$0.00	Not applicable. Must have a result before the person joins
Cost of INH Treatment	$444.45	Assumes that employees take 9x1hour off for visits to Public Health department
Cost of CXR	$90.65	EH staff time for test positive consultation + EH staff time to write up CXR Requisition + Cost of CXR itself + EH staff time for CXR review & INH consultation
Cost of completing screening for those with a prior positive test	$82.71	EH staff time for symptom scren + EH staff time for CXR Requisition + Cost of CXR itself + EH staff time for CXR review & INH consultation

Table 1b. Cost inputs for new hire model

Table 2 Results of the patient questionnaires administered to all study participants.

Q. If your PPD test result is positive, what level of confidence do you have with the test results?

	Highly Confident	Somewhat confident	No Confidence	Unable to answer	No answer	Total
Total Cohort	222	289	167	43	29	750
	29.6%	38.5%	22.3%	5.7%	3.9%	100.0%
Foreign-born	45	72	67	17	17	218
	20.6%	33.0%	30.7%	7.8%	7.8%	100.0%

Q. If your T-SPOT.TB test result is positive, what level of confidence do you have with the test result?

	Highly Confident	Somewhat confident	No Confidence	Unable to answer	No answer	Total
Total Cohort	353	207	49	135	6	750
	47.1%	27.6%	6.5%	18.0%	0.8%	100.0%
Foreign-born	79	70	16	52	1	218
	36.2%	32.1%	7.3%	23.9%	0.5%	100.0%

Q. Have you ever had any adverse reaction to the PPD test (e.g. blistering, scarring, pain etc)?

	Yes	No	No answer	Total
Total Cohort	94	655	1	750
	12.5%	87.3%	0.1%	100.0%
Foreign-born	51	166	1	218
	23.4%	76.1%	0.5%	100.0%

Q. Are there any reasons why a blood draw would be less desirable for you than the placement of the PPD?

	Yes	No	No answer	Total
Total Cohort	139	611	0	750
	18.5%	81.5%	0.0%	100.0%
Foreign-born	34	184	0	218
	15.6%	84.4%	0.0%	100.0%

Q. Based on your experience today and what you know about both tests, do you prefer the T-SPOT.*TB* test to the PPD test?

	Strongly prefer T-SPOT.*TB*	Slightly prefer T-SPOT.*TB*	I don't have a preference	Slightly prefer the PPD test	Strongly prefer the PPD test	No answer	Total
Total Cohort	314	153	228	31	18	6	750
	41.9%	20.4%	30.4%	4.1%	2.4%	0.8%	100.0%
Foreign-born	102	43	60	6	5	2	218
	46.8%	19.7%	27.5%	2.8%	2.3%	0.9%	100.0%

Tables 3a-d Results of different testing scenarios

Tables 3a-d show the results from the different model constructions used to show the cost impacts of different testing scenarios. In each table the model assumes an IGRA cost of $54.83 which is the value at which IGRA is cost-saving in the base case. The cost at which the IGRA becomes cost saving is also shown below each table for each scenario.

3a. Total costs of screening should no follow-up of non-returns be attempted

These results reflect our rates of 20% non-returns for TST reading in annual screens and 50% in new hires for reading of the second step test.

3b. Total costs of screening should all annual screening take place locally

This shows how the overall costs of completing screening using the TST or IGRA reduce for annual hires if all screening can take place locally (i.e. in a place convenient to employees) where time of work costs are reduced.

3c. Total costs of screening should all annual screening take place remotely

This shows how the overall costs of completing screening using the TST or IGRA increase for annual hires if all screening takes place remotely (e.g.at a separate employee health building) where time of work costs are increased.

3d. Total costs of screening should all borderline T-SPOT results be retested

	TST				IGRA			
	Numbers screened	Total cost	Cost/ person	% Completing screening	Numbers screened	Total cost	Cost/ person	% Completing screening
Annual screens	11454	$610,828	$53.33	82.02%	11454	$890,335	$77.73	99.59%
New Hires	6359	$326,234	$51.30	50.50%	6359	$409,969	$64.47	100.00%
TOTAL	17813	**$937,062**	**$52.61**	**70.77%**	17813	**$1,300,303**	**$73.00**	**99.74%**

IGRA test cost at which it becomes cost-saving	$33.98

3a. Total costs of screening should no follow-up of non-returns be attempted

	TST				IGRA			
	Numbers screened	Total cost	Cost/ person	% Completing screening	Numbers screened	Total cost	Cost/ person	% Completing screening
Annual screens	11454	$537,031	$46.89	99.10%	11454	$747,268	$65.24	99.98%
New Hires	6359	$577,416	$90.80	97.53%	6359	$409,969	$64.47	100.00%
TOTAL	17813	**$1,114,447**	**$62.56**	**98.54%**	17813	**$1,157,237**	**$64.97**	**99.99%**

IGRA test cost at which it becomes cost-saving	$52.38

3b. Total costs of screening should all annual screening take place locally

	TST				IGRA			
	Numbers screened	Total cost	Cost/ person	% Completing screening	Numbers screened	Total cost	Cost/ person	% Completing screening
Annual screens	11454	$830,551	$72.51	99.10%	11454	$1,000,254	$87.33	99.98%
New Hires	6359	$577,416	$90.80	97.53%	6359	$409,969	$64.47	100.00%
TOTAL	17813	**$1,407,967**	**$79.04**	**98.54%**	17813	**$1,410,223**	**$79.17**	**99.99%**

IGRA test cost at which it becomes cost-saving	$54.70

3c. Total costs of screening should all annual screening take place remotely

	TST				IGRA			
	Numbers screened	Total cost	Cost/ person	% Completing screening	Numbers screened	Total cost	Cost/ person	% Completing screening
Annual screens	11454	$726,440	$63.42	99.10%	11454	$908,673	$79.33	99.90%
New Hires	6359	$577,416	$90.80	97.53%	6359	$418,159	$65.76	100.00%
TOTAL	17813	**$1,303,855**	**$73.20**	**98.54%**	17813	**$1,326,832**	**$74.49**	**99.93%**

IGRA test cost at which it becomes cost-saving	$53.54

3d. Total costs of screening should all borderline T-SPOT results be retested

Figures

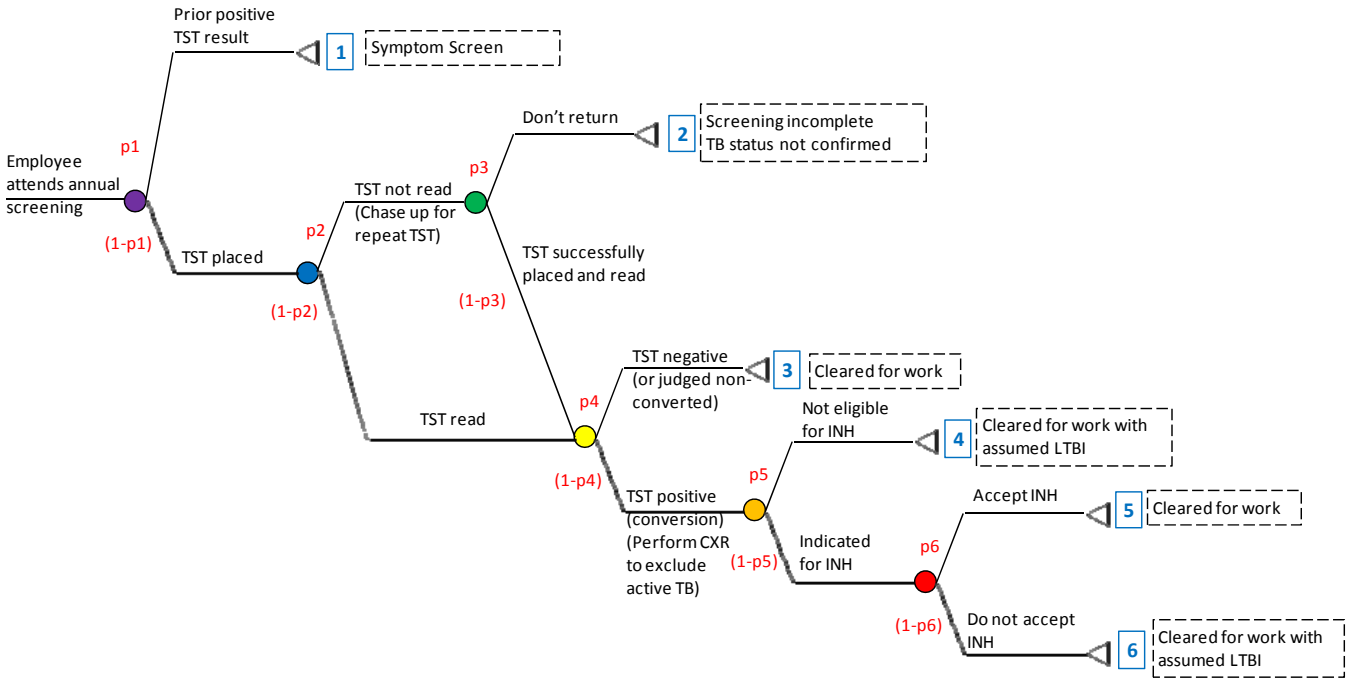
Figures 1a-e – The five decision-tree models.

In each decision-tree, red text denotes probabilities that need to be determined for each decision node (colored circles), blue numbers are used to label each of the possible final pathways that an employee could take during screening. Each decision-tree is accompanied by the derived input costs and input probabilities as well as model outputs in terms of costs of pathway, probability of ending up in each end state and the probability adjusted costs of each branch of the pathway which are summed to give the total costs of screening. In each case the tables shown the cost outputs using an IGRA cost of $54.83 which is the cost at which the IGRA is cost-saving overall.

a. Decision-tree for the TST in Annual Screens

Derived Cost inputs	$ per
Cost of symptom screen	$15.33
Cost of TST non-return	$35.04
Cost of TST (placement & reading for chased up initial non-returner)	$88.15
Cost of TST (placement & reading)	$54.09
Cost of CXR	$127.69
Cost of INH treatment	$317.30
Probability inputs	**Value**
p1	0.101
(1-p1)	0.899
p2	0.2
(1-p2)	0.8
p3	0.05
(1-p3)	0.95
p4	0.9976
(1-p4)	0.0024
p5	0.12
(1-p5)	0.88
p6	0.12
(1-p6)	0.88

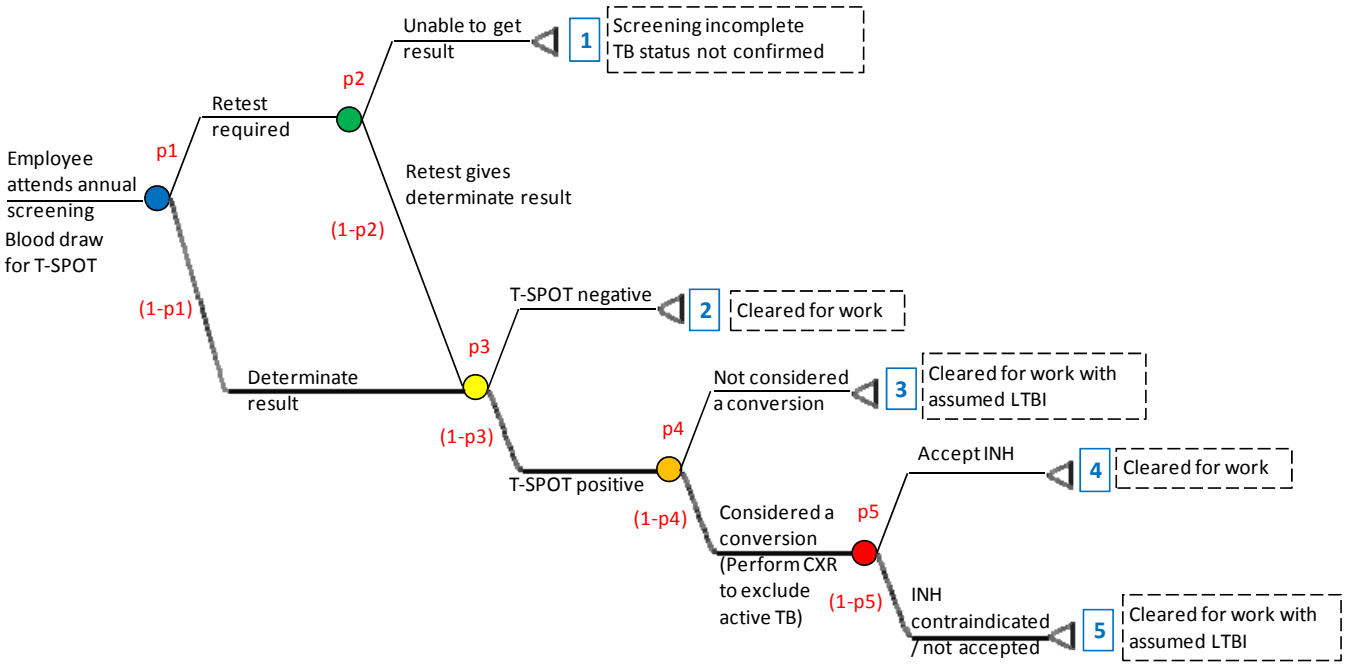
Destination (end state)	Costs (explanation)	Cost of pathway ($ per person)	Probabilities (explanation)	Probability of taking pathway	Total cost of pathway ($)
End state 1	Cost of symptom screen	$15.33	p1	0.101	$1.55
End state 2	Cost of TST non-return	$35.04	(1-p1)xp2xp3	0.009	$0.32
End state 3					
Top pathway	Cost of TST (placement & reading for chased up initial non-returner)	$88.15	(1-p1)xp2x(1-p3)xp4	0.170	$15.02
Bottom pathway	Cost of TST (placement & reading)	$54.09	(1-p1)x(1-p2)xp4	0.717	$38.81
End state 4					
Top pathway	Cost of TST (placement & reading for chased up initial non-returner) + Cost of CXR	$215.84	(1-p1)xp2x(1-p3)x(1-p4)xp5	0.000	$0.01
Bottom pathway	Cost of TST (placement & reading) + Cost of CXR	$181.78	(1-p1)x(1-p2)x(1-p4)xp5	0.000	$0.04
End state 5					
Top pathway	Cost of TST (placement & reading for chased up initial non-returner) + Cost of CXR + Cost of INH treatment	$533.14	(1-p1)xp2x(1-p3)x(1-p4)x(1-p5)xp6	0.000	$0.02
Bottom pathway	Cost of TST (placement & reading) + Cost of CXR + Cost of INH treatment	$499.08	(1-p1)x(1-p2)x(1-p4)x(1-p5)xp6	0.000	$0.09
End state 6					
Top pathway	Cost of TST (placement & reading for chased up initial non-returner) + Cost of CXR	$215.84	(1-p1)xp2x(1-p3)x(1-p4)x(1-p5)x(1-p6)	0.000	$0.07
Bottom pathway	Cost of TST (placement & reading) + Cost of CXR	$181.78	(1-p1)x(1-p2)x(1-p4)x(1-p5)x(1-p6)	0.001	$0.24
Fixed costs	Costs of maintaining trained TST placers/readers				$7.26
TOTAL				1.000	$63.42



b. Decision-tree for IGRA in Annual Screens (Year 1 – the year of switch)

Derived Cost inputs	$ per
Cost of T-SPOT non-return	$27.30
Cost of Determinate T-SPOT test	$106.87
Cost of Determinate T-SPOT test	$79.57
T-SPOT Positive consultation (no CXR indicated)	$4.54
Cost of CXR	$115.26
Cost of INH treatment	$317.30
Probability inputs	**Value**
p1	0.0042
(1-p1)	0.9958
p2	0.05
(1-p2)	0.95
p3	0.966
(1-p3)	0.034
p4	0.89
(1-p4)	0.11
p5	0.09
(1-p5)	0.91

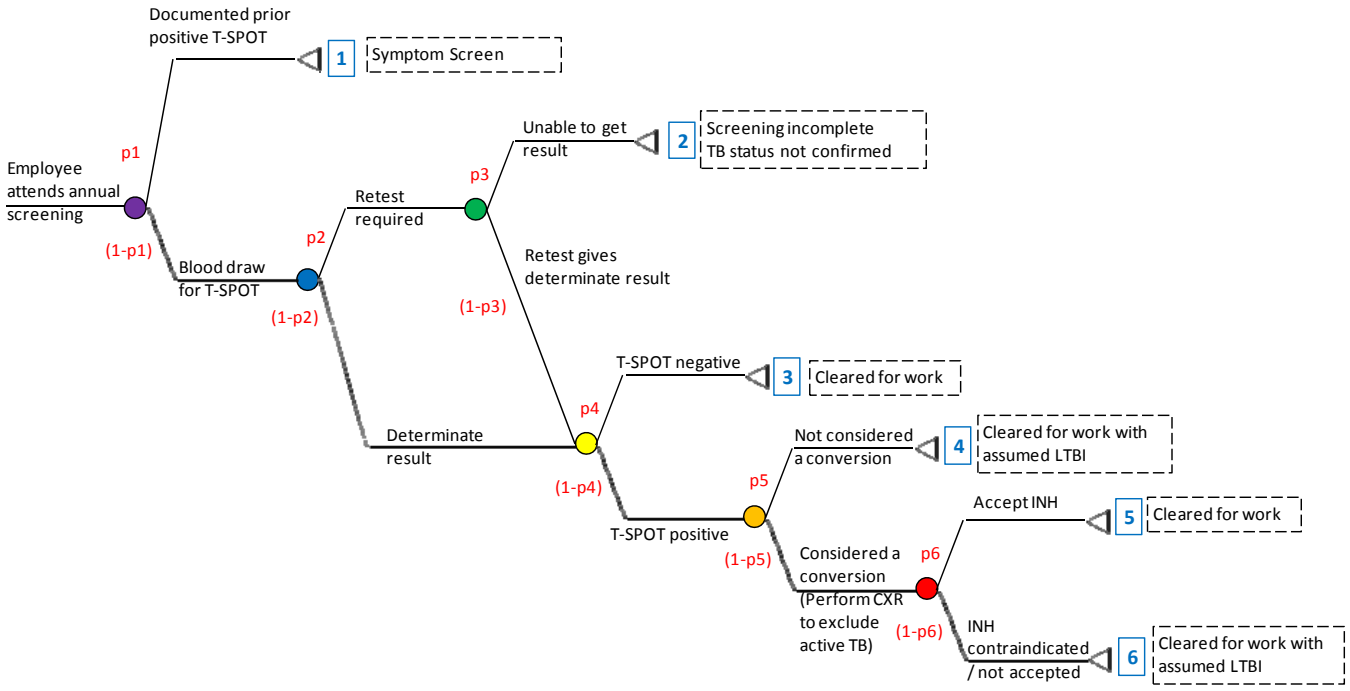
Destination (end state)	Costs (explanation)	Cost of pathway ($ per person)	Probabilities (explanation)	Probability of taking pathway	Total cost of pathway ($)
End state 1	Cost of T-SPOT non-return	$27.30	p1xp2	0.000	$0.01
End state 2					
Top pathway	Cost of Determinate T-SPOT test (after repeat test)	$106.87	p1x(1-p2)xp3	0.004	$0.41
Bottom pathw	Cost of Determinate T-SPOT test	$79.57	(1-p1)xp3	0.962	$76.55
End state 3					
Top pathway	Cost of Determinate T-SPOT test (after repeat test) + T-SPOT Positive consultation (no CXR indicated)	$111.41	p1x(1-p2)x(1-p3)xp5	0.000	$0.00
Bottom pathw	Cost of Determinate T-SPOT test + T-SPOT Positive consultation (no CXR indicated)	$84.11	(1-p1)x(1-p3)xp4	0.030	$2.53
End state 4					
Top pathway	Cost of Determinate T-SPOT test (after repeat test) + Cost of CXR + Cost of INH Treatment	$539.43	p1x(1-p2)x(1-p3)x(1-p4)xp5	0.000	$0.00
Bottom pathw	Cost of Determinate T-SPOT test + Cost of CXR + Cost of INH treatment	$512.13	(1-p1)x(1-p3)x(1-p4)xp5	0.000	$0.17
End state 5					
Top pathway	Cost of Determinate T-SPOT test (after repeat test) + Cost of CXR	$222.13	p1x(1-p2)x(1-p3)x(1-p4)x(1-p5)	0.000	$0.00
Bottom pathw	Cost of Determinate T-SPOT test + Cost of CXR	$194.83	(1-p1)x(1-p3)x(1-p4)x(1-p5)	0.003	$0.66
TOTAL				1.000	$80.33



c. Decision-tree for IGRA in Annual Screens (Year 2 – steady-state)

Derived Cost inputs	$ per
Cost of symptom screen	$15.33
Cost of T-SPOT non-return	$27.30
Cost of Determinate T-SPOT test	$106.87
Cost of Determinate T-SPOT test	$79.57
T-SPOT Positive consultation (no CXR indicated)	$4.54
Cost of CXR	$115.26
Cost of INH treatment	$317.30
Probability inputs	**Value**
p1	0.03
(1-p1)	0.97
p2	0.004
(1-p2)	0.996
p3	0.05
(1-p3)	0.95
p4	0.9976
(1-p4)	0.0024
p5	0
(1-p5)	1
p6	0.09
(1-p6)	0.91

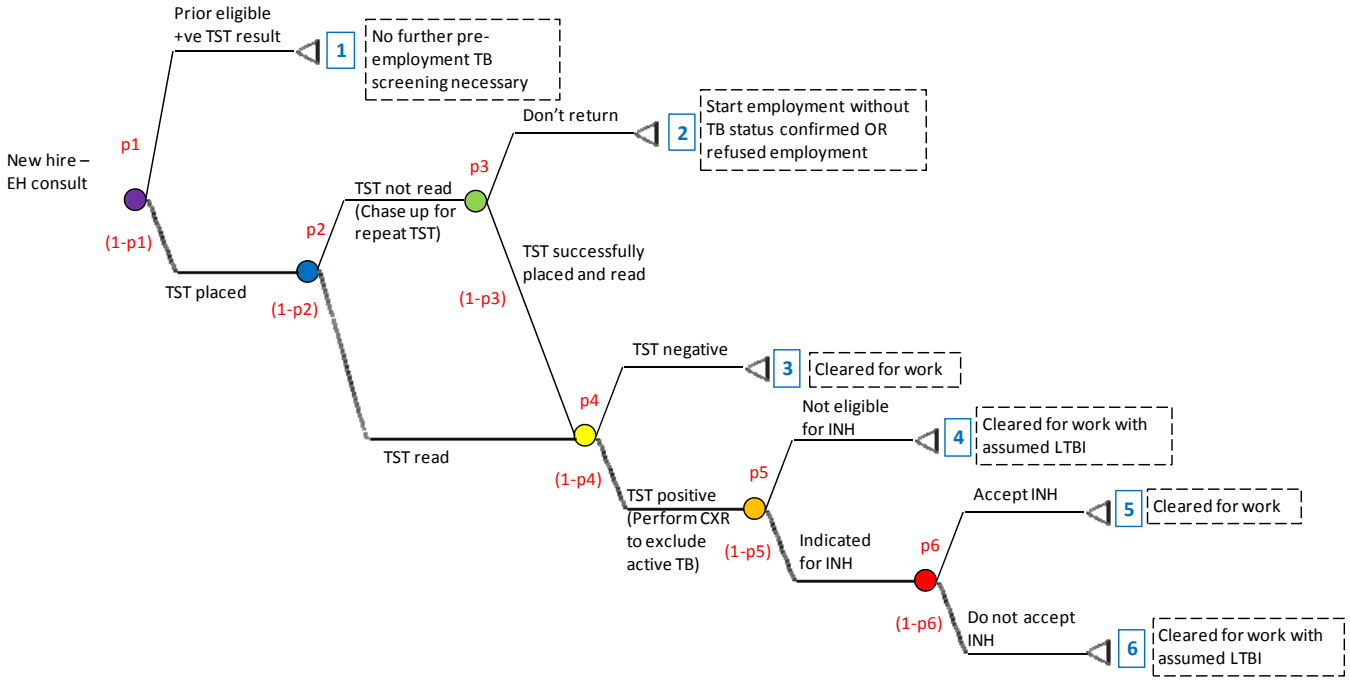
Destination (end state)	Costs (explanation)	Cost of pathway ($ per person)	Probabilities (explanation)	Probability of taking pathway	Total cost of pathway ($)
End state 1	Cost of symptom screen	$15.33	p1	0.030	$0.47
End state 2	Cost of T-SPOT non-return	$27.30	(1-p1)xp2xp3	0.000	$0.01
End state 3					
Top pathway	Cost of Determinate T-SPOT test (after repeat test)	$106.87	(1-p1)xp2x(1-p3)xp4	0.004	$0.41
Bottom pathw	Cost of Determinate T-SPOT test	$79.57	(1-p1)x(1-p2)xp4	0.963	$76.65
End state 4					
Top pathway	Cost of Determinate T-SPOT test (after repeat test) + T-SPOT Positive consultation (no CXR indicated)	$111.41	(1-p1)xp2x(1-p3)x(1-p4)xp5	0.000	$0.00
Bottom pathw	Cost of Determinate T-SPOT test + T-SPOT Positive consultation (no CXR indicated)	$84.11	(1-p1)x(1-p2)x(1-p4)xp5	0.000	$0.00
End state 5					
Top pathway	Cost of Determinate T-SPOT test (after repeat test) + Cost of CXR + Cost of INH Treatment	$539.43	(1-p1)xp2x(1-p3)x(1-p4)x(1-p5)xp6	0.000	$0.00
Bottom pathw	Cost of Determinate T-SPOT test + Cost of CXR + Cost of INH treatment	$512.13	(1-p1)x(1-p2)x(1-p4)x(1-p5)xp6	0.000	$0.11
End state 6					
Top pathway	Cost of Determinate T-SPOT test (after repeat test) + Cost of CXR	$222.13	(1-p1)xp2x(1-p3)x(1-p4)x(1-p5)x(1-p6)	0.000	$0.00
Bottom pathw	Cost of Determinate T-SPOT test + Cost of CXR	$194.83	(1-p1)x(1-p2)x(1-p4)x(1-p5)x(1-p6)	0.002	$0.41
TOTAL				1.000	$78.05



d. Decision-tree for the TST in New Hires

Derived Cost inputs	$ per
Cost of prior eligible positive resul	$82.71
Cost of TST non-return	$16.20
Cost of TST (placement & reading for chased up initial non-returner)	$86.70
Cost of TST (placement & reading)	$81.38
Cost of CXR	$90.65
Cost of INH treatment	$444.45
Probability inputs	**Value**
p1	0.01
(1-p1)	0.99
p2	0.5
(1-p2)	0.5
p3	0.05
(1-p3)	0.95
p4	0.92
(1-p4)	0.08
p5	0.85
(1-p5)	0.15
p6	0.12
(1-p6)	0.88

Destination (end state)	Costs (explanation)	Cost of pathway ($ per person)	Probabilities (explanation)	Probability of taking pathway	Total cost of pathway ($)
End state 1	Cost of prior eligible positive result	$82.71	p1	0.010	$0.83
End state 2	Cost of TST non-return (non-compliant)	$16.20	(1-p1)xp2xp3	0.025	$0.40
End state 3					
Top pathway	Cost of TST (placement & reading for chased up initial non-returner)	$86.70	(1-p1)xp2x(1-p3)xp4	0.433	$37.51
Bottom pathwa	Cost of TST (placement & reading)	$81.38	(1-p1)x(1-p2)xp4	0.455	$37.06
End state 4					
Top pathway	Cost of TST (placement & reading for chased up initial non-returner) + Cost of CXR	$177.35	(1-p1)xp2x(1-p3)x(1-p4)xp5	0.032	$5.64
Bottom pathwa	Cost of TST (placement & reading) + Cost of CXR	$172.03	(1-p1)x(1-p2)x(1-p4)xp5	0.034	$5.76
End state 5					
Top pathway	Cost of TST (placement & reading for chased up initial non-returner) + Cost of CXR + Cost of INH	$621.80	(1-p1)xp2x(1-p3)x(1-p4)x(1-p5)xp6	0.001	$0.43
Bottom pathwa	Cost of TST (placement & reading) + Cost of CXR + Cost of INH	$616.48	(1-p1)x(1-p2)x(1-p4)x(1-p5)xp6	0.001	$0.45
End state 6					
Top pathway	Cost of TST (placement & reading for chased up initial non-returner) + Cost of CXR	$177.35	(1-p1)xp2x(1-p3)x(1-p4)x(1-p5)x(1-p6)	0.005	$0.91
Bottom pathwa	Cost of TST (placement & reading) + Cost of CXR	$172.03	(1-p1)x(1-p2)x(1-p4)x(1-p5)x(1-p6)	0.005	$0.92
Fixed costs	Costs of maintaining trained TST placers/readers				$0.90
TOTAL				1.000	$90.80



e. Decision-tree for IGRA in New Hires

Derived Cost inputs	$ per
Cost of prior eligible positive resul	$82.71
Cost of Determinate T-SPOT test (after repeat test)	$61.01
Cost of Determinate T-SPOT test	$57.99
Cost of CXR	$90.65
Cost of INH treatment	$444.45
Probability inputs	**Value**
p1	0.00
(1-p1)	1.00
p2	0.004
(1-p2)	0.996
p3	0.00
(1-p3)	1.00
p4	0.95
(1-p4)	0.05
p5	0.12
(1-p5)	0.88
p6	0.12
(1-p6)	0.88

Destination (end state)	Costs (explanation)	Cost of pathway ($ per person)	Probabilities (explanation)	Probability of taking pathway	Total cost of pathway ($)
End state 1	Cost of prior eligible positive result	$82.71	p1	0.000	$0.00
End state 2	N/A. If they don't complete screening, they don't join	$0.00	(1-p1)xp2xp3	0.000	$0.00
End state 3					
Top pathway	Cost of Determinate T-SPOT test (after repeat test)	$61.01	(1-p1)xp2x(1-p3)xp4	0.004	$0.22
Bottom pathwa	Cost of Determinate T-SPOT test	$57.99	(1-p1)x(1-p2)xp4	0.949	$55.05
End state 4					
Top pathway	Cost of Determinate T-SPOT test (after repeat test) + Cost of CXR	$151.66	(1-p1)xp2x(1-p3)x(1-p4)xp5	0.000	$0.00
Bottom pathwa	Cost of Determinate T-SPOT test + Cost of CXR	$148.64	(1-p1)x(1-p2)x(1-p4)xp5	0.006	$0.84
End state 5					
Top pathway	Cost of TST (placement & reading for chased up initial non-returner) + Cost of CXR + Cost of INH	$596.11	(1-p1)xp2x(1-p3)x(1-p4)x(1-p5)xp6	0.000	$0.01
Bottom pathwa	Cost of TST (placement & reading) + Cost of CXR + Cost of INH	$593.09	(1-p1)x(1-p2)x(1-p4)x(1-p5)xp6	0.005	$2.91
End state 6					
Top pathway	Cost of Determinate T-SPOT test (after repeat test) + Cost of CXR	$151.66	(1-p1)xp2x(1-p3)x(1-p4)x(1-p5)x(1-p6)	0.000	$0.02
Bottom pathwa	Cost of Determinate T-SPOT test + Cost of CXR	$148.64	(1-p1)x(1-p2)x(1-p4)x(1-p5)x(1-p6)	0.036	$5.42
TOTAL				1.000	$64.47