

# Cost-Effectiveness of Pharmacist-Provided Treatment of Adult Pharyngitis

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**T**here are over 12 million ambulatory care visits for acute pharyngitis annually in the United States.<sup>1</sup> Approximately 15% to 30% of these cases are attributable to group A streptococcus (GAS) in children, and 5% to 10% in adults.<sup>2</sup> Treatment of pharyngitis caused by GAS, or strep throat, has traditionally been initiated in the setting of a clinic and performed by a physician or mid-level practitioner. Protocols for the treatment of GAS pharyngitis are available, but there is some debate over which approach is optimal. The current guidelines from the Infectious Diseases Society of America recommend that adults be diagnosed through culture or rapid antigen detection test (RADT) if the physician cannot confidently exclude the diagnosis of GAS on epidemiological or clinical grounds. The Infectious Diseases Society of America guidelines do not recommend confirmation of a negative RADT test with culture in adults.<sup>3</sup> In actual practice, physicians are likely to use a variety of strategies when diagnosing and managing GAS pharyngitis. These include observation with no testing or treatment, empiric treatment of all patients with suspected GAS pharyngitis, testing with culture alone, testing with RADT alone, and testing with RADT with a follow-up culture for negative results.

In recent years, pharmacists in the community setting have taken on more diversified roles as frontline healthcare providers. Examples of these expanded roles include providing vaccinations, offering travel medicine services, managing anticoagulation clinics, and identifying and treating patients with influenza. Another possible expansion of pharmacist services would be the diagnosis and treatment of GAS pharyngitis. While the pharmacist could never replace the physician in the diagnosis and treatment of complex patients, it is possible that pharmacists could provide a cost-effective treatment alternative for disease states such as GAS pharyngitis. For diseases such as GAS pharyngitis, use of a pharmacist-as-provider care model might yield cost savings through reduced provider expenses and improved access to care resulting in fewer missed days of school and/or work and containment of disease.

Few data evaluating pharmacist-provided care for GAS have been published. A study from 1978 concluded that cost savings could be realized through pharmacist management of streptococcal throat infections; however, this study was relatively small and not reflective of contemporary practice.<sup>4</sup> In 2002 the National Community Pharmacists Association, in collaboration with US Wellness Inc, implemented a program to train pharmacists to

**Background:** There are over 12 million ambulatory care visits for acute pharyngitis annually in the United States. Current guidelines recommend diagnosis through culture or rapid antigen detection test (RADT) and relatively straightforward treatment. Community pharmacists may provide cost-effective care for disease states such as group A streptococcus (GAS) pharyngitis.

**Objectives:** The objective of this research is to evaluate the cost-effectiveness of a community pharmacist-as-provider program for the diagnosis and treatment of pharyngitis caused by GAS as compared with standard of care.

**Methods:** A cost-effectiveness analysis was conducted to compare treatment for adult pharyngitis patients. In addition to 5 physician-provided treatment strategies, the episodic costs and benefits of treatment provided by pharmacists using RADT and walk-in clinics using RADT were also considered. Model parameters were derived through a comprehensive review of literature and from the Centers for Medicare & Medicaid Services physician fee schedule. Utilities were expressed in quality-adjusted life-days (QALDs) to account for the relatively short duration of most cases of pharyngitis.

**Results:** Using a cost-effectiveness threshold of \$137 per QALD, GAS treatment provided by a pharmacist was the most cost-effective treatment. Pharmacist treatment dominated all of the other methods except physician culture and physician RADT with follow-up culture. The incremental cost-effectiveness ratio (ICER) for physician culture was \$6042 per QALD gained and \$40,745 for physician RADT with follow-up culture.

**Conclusions:** This model suggests that pharmacists may be able to provide a cost-effective alternative for the treatment of pharyngitis caused by GAS in adult patients.

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temporary practice.<sup>4</sup> In 2002 the National Community Pharmacists Association, in collaboration with US Wellness Inc, implemented a program to train pharmacists to

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### Take-Away Points

This study is the first to show that community pharmacy–based rapid diagnostic testing and treatment for group A streptococcus (GAS) pharyngitis may be a cost-effective treatment strategy.

- Improved rapid diagnostic testing and well-known treatment protocols make GAS an ideal disease for treatment in alternate settings including community pharmacies.
- Treatment in a community pharmacy allows for more convenient and less expensive treatment for GAS.
- Policy makers and payers looking to reduce overall healthcare costs should consider supporting cost-effective strategies such as utilizing community pharmacies as primary care providers.

conduct rapid strep testing in the community pharmacy and charge for this service.<sup>5</sup> The status of this initiative is unknown, but testing for GAS is not yet a common practice in community pharmacies. Additional studies have evaluated the cost associated with the management of GAS, but these do not consider the possibility of pharmacist-provided care.<sup>6,7</sup>

This research will provide the first cost-effectiveness evaluation of a pharmacist-as-provider program for the diagnosis and treatment of GAS pharyngitis as compared with standard of care provided by physicians and nurse practitioners.

## METHODS

### Decision Model

In order to evaluate the cost-effectiveness of pharmacist-provided care for GAS pharyngitis, a decision model was constructed. This model was largely based on the decision model used in the Neuner study, which consisted of 5 arms designed to determine the best method of treatment of pharyngitis in a physician's office.<sup>6</sup> As with the Neuner model, patients included in this model were adults presenting with acute pharyngitis. High-risk patients, such as the immunocompromised, were not included in our model since those patients generally require additional follow-up to monitor their therapy. Our final treatment model consisted of 7 arms: 1) physician observation only; 2) physician treatment of all patients empirically with antibiotics; 3) physician performing a throat culture on all patients; 4) physician performing an RADT on all patients, and performing a throat culture on those with a negative RADT result; 5) physician performing only an RADT; 6) a nurse practitioner in a walk-in clinic performing an RADT on all patients; 7) a pharmacist performing an RADT on all patients in a community pharmacy setting. The first 5 arms are identical to those of the Neuner study. The nurse practitioner arm was added to assess the effect of a recent rise in urgent care clinics, which are often staffed by nurse practitioners. Although the Neuner study concluded that culturing all patients is the most cost-effective method

of diagnosis and management of patients with pharyngitis, we elected to include all 5 arms in our model because this allowed us to compare a pharmacy-based treatment model with various medical practices, not simply what is considered the ideal.

Possible complications of GAS were considered in building the decision tree. These complications included acute rheumatic fever (ARF), peritonsillar abscess, and allergic reaction to penicillin. Other complications reported in the literature but not included in our model include glomerulonephritis, otitis media, and sinusitis. A recent Cochrane review described the effect of antibiotics in preventing glomerulonephritis, otitis media, and sinusitis as compared with placebo.<sup>8</sup> For these complications, the difference between the rate of complications with and without antibiotics was determined not to be clinically significant and left the authors to speculate if GAS truly causes these complications or if they are simply associated with one another.

The decision tree model was constructed and analyzed using the TreeAge Pro Suite 2009 version 1.0.2. The **Figure** represents the pharmacy arm of the tree. The entire tree can be seen in **Appendices A-H**.

### Assumptions

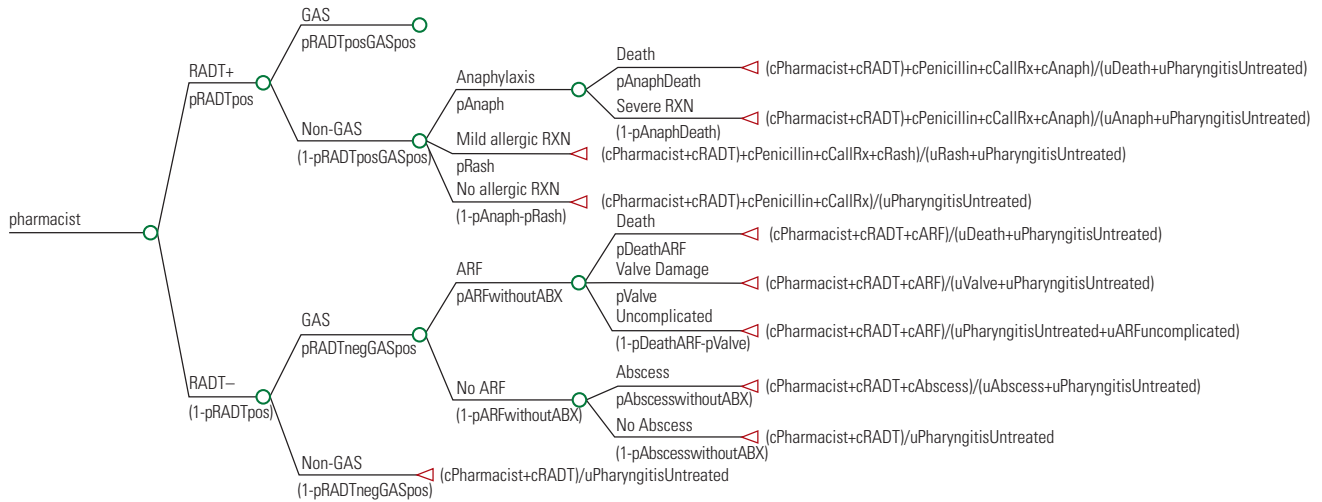
As with the Neuner model, certain assumptions were made. First, patients were assumed to have no history of ARF or a penicillin allergy. Screening for high-risk patients was assumed to be 100% effective in all settings. Patients developing ARF were assumed to develop no other complication. Patient adherence to therapy is assumed to be 100%. A willingness-to-pay parameter of \$137 per quality-adjusted life-day (QALD) was used. This number was based on the common standard of a willingness-to-pay of \$50,000 per quality-adjusted life-year (QALY), which was then divided by 365 days in the year.

Our model assumes that the visits in all arms include similar procedures with the exception of the previously described differences in treatment strategy. This includes a basic physical examination of the respiratory system and neck, the collection of vital signs, and detailed written record of the encounter.

It was assumed that pharmacists would be able to carry out the physical assessment and RADT testing with same effectiveness as a physician or a nurse practitioner. It was surmised that pharmacists would be able to dispense antibiotics to the appropriate patients at the pharmacy immediately after

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■ **Figure.** Simplified Depiction of the Pharmacist Treatment Arm of the Decision Tree Used



\*The sequelae for GAS can be seen in [Appendix A](#). Other arms of the model along with the sequelae for GAS are available in [Appendices A-H](#). ARF indicates acute rheumatic fever; GAS, group A streptococcus; RADT, rapid antigen detection test; RXN, reaction.

RADT testing. This could be possible through a collaborative practice agreement set up with a physician, similar to how collaborative practice agreements are set up for the administration of vaccines in the community pharmacy setting. Finally, it is assumed that there is no cost associated with the establishment of a collaborative practice agreement.

### Data Sources

The costs and probabilities used in the model are described in [Table 1](#). The probabilities used in our study were largely those used in the Neuner study as well as in the Cochrane review.<sup>6,8</sup> The original sources of the probabilities were reviewed to verify the quality of the information. The authors of the Neuner study averaged the results of several studies to determine the sensitivity and specificity of the RADT test. We used these averaged values, along with the prevalence of GAS, to calculate the following probabilities: RADT positive test result, true positive, true negative, false positive, and false negative.

Cost information was taken from several sources. The cost of penicillin and treatment of the adverse events of penicillin-induced rash, anaphylaxis, peritonsillar abscess, and acute rheumatic fever were taken from the Neuner study.<sup>6</sup> Since these values were given in US dollars from 2000, it was necessary to update these costs to reflect the effect of inflation. From April 2000 to April 2010, the healthcare inflation rate was 1.5, meaning that \$1.00 in 2000 would have the same purchasing power as \$1.50 in 2010.<sup>15</sup> Therefore, the cost of penicillin and the cost of treatment of adverse effects from the Neuner article were multiplied by 1.5 to reflect current costs. The cost of a physician visit was based on the 2010 physician

fee schedule from the Centers for Medicare & Medicaid Services (CMS) using a Healthcare Common Procedure Coding System (HCPCS) code of 99213, which allows 15 minutes of face-to-face time with the patient and/or family.<sup>16</sup> Cost for a walk-in clinic was also calculated using the CMS physician fee schedule based on the fact that a nurse practitioner is reimbursed at a rate of 85% of a physician.<sup>17</sup> Pharmacist reimbursement was based on reimbursement rates for provision of medication therapy management (MTM) services, which are currently billable services to Medicare.<sup>18,19</sup> CMS reimbursement rates for a throat culture and RADT were also used.<sup>14</sup> A Current Procedural Terminology (CPT) code of 87880QW was used for the RADT, and a CPT code of 87070 was used for the culture. One should note that practitioner time is considered a separate cost from testing. For example, if a patient went into a walk-in clinic and received an RADT test, the cost would be \$55.80 (practitioner time) + \$17.18 (cost of test).

Utility information was the same as what was used in the Neuner study, which was given in lost QALDs. A utility of 0.95 per day was assigned to pharyngitis, which is the utility associated with other minor symptoms such as diarrhea and dyspepsia.<sup>20</sup> Therefore, the QALDs lost with pharyngitis are based on the duration of symptoms. Untreated pharyngitis is associated with symptom duration of 5 days for a total QALD loss of 0.25. Similarly, pharyngitis treated after culture diagnosis is associated with a symptom duration of 4 days due to the delay in initiating therapy, and pharyngitis treated empirically or after RADT is associated with a symptom duration of 3 days. The Neuner study assigned utilities to anaphylaxis, penicillin-induced rash, and ARF based on a patient survey,<sup>21</sup>

■ **Table 1.** Probabilities, Costs, and Utilities Used in Decision Model

Probabilities	Variable Name	Baseline	Low	High
Pharyngitis caused by GAS <sup>9</sup>	pGAS	0.097	0.02	0.68
RADT + test result <sup>6</sup>	pRADTpos	0.137	0.0296	0.6764
RADT + true positive <sup>6</sup>	pRADTposGASpos	0.629	0.06	0.995
RADT - false negative <sup>6</sup>	pRADTnegGASpos	0.013	0.000206	0.443
Anaphylaxis <sup>10</sup>	pAnaph	0.0001	0.00005	0.0002
Death from anaphylaxis <sup>10</sup>	pAnaphDeath	0.1	0.05	0.2
Penicillin rash <sup>6</sup>	pRash	0.02	0.005	0.04
ARF with antibiotics <sup>11</sup>	pARFwithABX	0.00015	0	0.009
ARF without antibiotics <sup>8</sup>	pARFwithoutABX	0.0005	0	0.03
Death from ARF <sup>12,13</sup>	pDeathARF	0.01	0.005	0.02
Valve damage from ARF <sup>12</sup>	pValve	0.1	0.025	0.2
Abscess with antibiotics <sup>8</sup>	pAbscesswithABX	0.00139	0	0.00338
Abscess without antibiotics <sup>8</sup>	pAbscesswithoutABX	0.023	0	0.056
<b>Costs (in 2010 US dollars)</b>				
RADT <sup>14</sup>	cRADT	17.18	12.91	17.18
Calling in prescription <sup>6,15</sup>	cCallRx	1.92	0.96	3.84
Culture <sup>14</sup>	cCulture	12.34	5.38	12.34
Penicillin <sup>6,15</sup>	cResult	15.075	7.545	30.15
Penicillin-induced rash <sup>6,15</sup>	cRash	76.41	38.205	153
Anaphylaxis <sup>6,15</sup>	cAnaph	2658.81	1329	5317.5
Peritonsillar abscess <sup>6,15</sup>	cAbscess	6553.74	3277.5	13,107
Uncomplicated ARF <sup>6,15</sup>	cARF	2825.97	1413	5652
Physician office visit <sup>16</sup>	cPhysician	65.67	58	114
Walk-in clinic visit <sup>16,17</sup>	cWalkin	55.8	49.3	96.9
Pharmacist visit <sup>18,19</sup>	cPharmacist	30	25	30
<b>Utilities (in quality-adjusted life-days)</b>				
Untreated pharyngitis <sup>6,20</sup>	uPharyngitisUntreated	0.25	0	0.5
Treated GAS after RADT <sup>6,20</sup>	uGASTreatedRADT	0.15	0.1	0.25
Treated GAS after culture <sup>6,20</sup>	uGASTreatedCulture	0.2	0.15	0.25
Treated GAS empirically <sup>6,20</sup>	uGASTreatedEmpiric	0.15	0.1	0.25
Penicillin-induced rash <sup>6,21</sup>	uRash	0.625	0.15	1.5
Anaphylaxis <sup>6,21</sup>	uAnaph	9	3	18
Peritonsillar abscess <sup>6,12</sup>	uAbscess	5	1.65	10
Uncomplicated ARF <sup>6,21</sup>	uARFuncomplicated	76.5	9	744
Valve damage from ARF <sup>6,21</sup>	uValve	744	56	744
Death <sup>6</sup>	uDeath	—	—	14874

ARF indicates acute rheumatic fever; GAS, group A streptococcus; RADT, rapid antigen detection test.

and assigned utility to peritonsillar abscess based on a previous decision analysis that used expert opinion.<sup>12</sup>

## RESULTS

### Baseline Analysis

Using our baseline probabilities, costs, and utilities, treatment of GAS pharyngitis by a pharmacist was the most cost-effective treatment strategy (measured in dollars/QALDs gained). Pharmacist treatment dominated all of the other

methods except physician culture and physician RADT with follow-up culture (**Table 2**). The incremental cost-effectiveness ratio (ICER) for physician culture was \$6042 per QALD gained and \$40,745 for physician RADT with follow-up culture. Both values greatly exceed the \$137 per QALD threshold.

As seen in Table 2, the QALDs lost with all of the treatments were quite comparable, with the exception of empirical treatment by a physician. There is a difference of 0.0096 QALDs between physician culture and physician

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observation. Since the differences among strategies were negligible, this indicated that all treatments (excluding physician empirical therapy) are equally effective. Therefore, a cost-minimization approach may be taken in analyzing the data rather than a cost-effectiveness approach, choosing the treatment method with the lowest overall cost.

### Sensitivity Analyses

A one-way sensitivity analysis was performed on all probability and cost variables using a cost-minimization strategy. The variable for RADT negative GAS positive (false negative) probability was the only variable that changed the study results in the sensitivity analysis.

**RADT Negative GAS Positive.** This is the probability that an RADT test result will be negative, but that the patient will still be GAS positive. At a false negative probability of  $\geq 0.22$ , physician observation is the cost-minimizing option at \$80.40 followed by physician culture at a false negative probability of  $\geq 0.24$  and a cost of \$82.30.

**Pharmacist Cost.** A threshold analysis was conducted to see at what point pharmacist-provided care is not the most cost-minimizing option. At a pharmacist cost of \$55.56, walk-in clinics become the cost-minimizing option.

## DISCUSSION

Of the 7 strategies studied, pharmacist-provided care was the most cost-effective strategy as well as the cost-minimizing strategy for the diagnosis and treatment of GAS pharyngitis in adults. Only the rate of false negatives affected the results in a sensitivity analysis for the cost-minimization strategy. The results change at a false negative rate  $\geq 0.22$ , which is considerably higher than the baseline false negative rate of 0.013. The probability of a false negative can be calculated by subtracting the true positive rate from the GAS prevalence, and the true positive rate is calculated by multiplying the sensitivity by the GAS prevalence. Therefore, the false negative probability can be raised by either raising the GAS prevalence or lowering the sensitivity. If sensitivity is lowered and GAS prevalence is kept at baseline, the false negative rate is 0.033. If the sensitivity is kept at baseline and the GAS prevalence is raised, the false negative rate becomes 0.21. Therefore, both variables need to be adjusted concurrently to achieve a false negative  $\geq 0.22$ . Because of the unlikelihood of achieving a false negative probability as high as 0.22, we are confident in the robustness of our

**Table 2.** Cost-effectiveness of Baseline GAS Treatment Strategies Using Baseline Variables

Strategy	Cost	QALDs lost	ICER <sup>a</sup>
Pharmacist	53.56	0.2707	
Walk-in clinic RADT alone	79.12	0.2707	Dominated
Physician observation	80.42	0.2753	Dominated
Physician culture	83.77	0.2657	\$6042/QALD
Physician empiric therapy	84.92	0.4072	Dominated
Physician RADT alone	88.97	0.2707	Dominated
Physician RADT and culture	98.38	0.2696	\$40,745/QALD <sup>b</sup>

<sup>a</sup>All ICER comparisons are to pharmacist managed care.  
<sup>b</sup>Physician culture dominates physician RADT and culture.  
 ICER indicates incremental cost-effectiveness ratio; QALD, quality-adjusted life-day; RADT, rapid antigen detection test.

conclusion that pharmacists are the most cost-minimizing option.

Whether or not patients would accept pharmacists as the healthcare provider for diagnosis and treatment of GAS pharyngitis is unknown. A pharmacy-based service that could serve as an indicator to answer this question is immunization. Prior to 1996, only 9 states allowed pharmacists to give immunizations.<sup>22</sup> As of June 2009, all 50 states allow pharmacists to be immunizers.<sup>23</sup> This rapid growth of pharmacy-based immunization seems to indicate that patients are willing to accept pharmacists as providers of low-complexity medical care.

A challenge for the implementation of pharmacy-based diagnosis and treatment of GAS pharyngitis is the development of a procedure for incorporating testing into the normal pharmacy work flow. Unlike immunizations, GAS testing cannot be scheduled for certain days or times of day. Rather, patients requesting testing must be helped as they come in. A recommended procedure for handling these patients is as follows: 1) screen out and refer to physicians high-risk patients such as pregnant women or the immunocompromised; 2) collect a history of the current illness from patient; 3) conduct physical examination of respiratory system and neck and collect vital signs; 4) perform RADT test; 5) bill for testing services; 6) prescribe antibiotics for those testing positive based on a treatment protocol; 7) dispense antibiotics for those testing positive, and recommend over-the-counter therapy for those testing negative; 8) produce detailed written record of encounter to be shared with primary care physician. All patients should be encouraged to follow up with their primary care physician if symptoms worsen or do not improve within 48 to 72 hours.

Another challenge for the implementation of pharmacy-based treatment for GAS pharyngitis is the lack of ability of



pharmacists to bill for these cognitive services. The RADT test itself can be billed through its existing CPT code. However, pharmacists cannot currently bill for the time to provide such a service, as such a CPT/HCPCS code does not exist. It is conceivable that a code could be added, though, based on the addition of an HCPCS code for the provision of MTM services with the passage of Medicare part D.

The current research is based on a number of assumptions that allow pharmacists to provide GAS pharyngitis treatment. In particular, states may require that pharmacists obtain additional training and/or credentialing prior to performing this service. The requirements will vary by state and may impact the ability of pharmacists to conduct the service as described.

Future research needs to look at how implementing pharmacist-based GAS pharyngitis treatment fits into a pharmacy business model. Performing GAS testing would take time away from the more traditional dispensing function. It would only make sense from a business perspective to implement this new service if the profit made from performing GAS testing were equal to or greater than the profit gained from dispensing prescriptions within that same amount of time. We know from the threshold analysis that pharmacists are the most cost-minimizing option, at a cost below \$55.56, so the maximum fee charged by a pharmacy to test for GAS would be \$72.74 (\$55.56 for pharmacist cost and \$17.18 for RADT test cost). In determining the profitability of GAS testing, one also needs to consider the costs associated with additional training and credentialing and setting up a collaborative practice agreement. Neither of these costs nor the profits gained from filling prescriptions to treat GAS pharyngitis were considered in this decision model. Finally, since this study only evaluates the adult population, future research needs to evaluate the pediatric population. This may be especially important since GAS prevalence is higher in the pediatric population than the adult population.

The role of pharmacists in the healthcare system is constantly evolving. Recent publications highlighting the role of community-based pharmacists as frontline healthcare providers and gatekeepers to the healthcare system have demonstrated an intriguing new role for pharmacists. Identifying and treating patients early in the course of their disease has several potential benefits to patients, society, and the healthcare system. Since pharmacists are highly accessible and have established practice sites, they offer the potential to impact the course of many diseases in a highly cost-effective manner. More studies need to be conducted demonstrating the clinical and economic value of pharmacists practicing in this manner.

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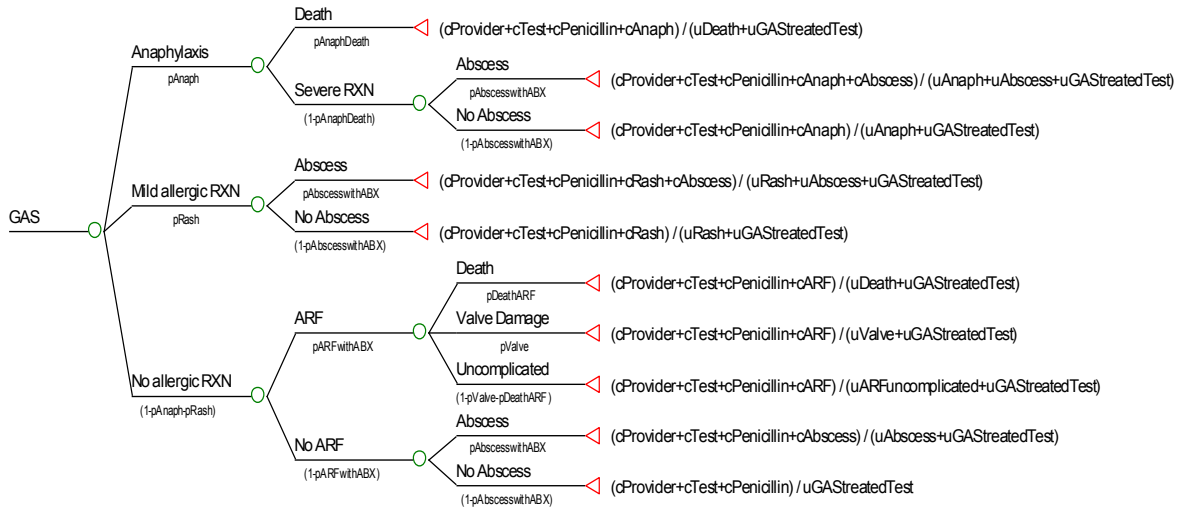
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Appendices

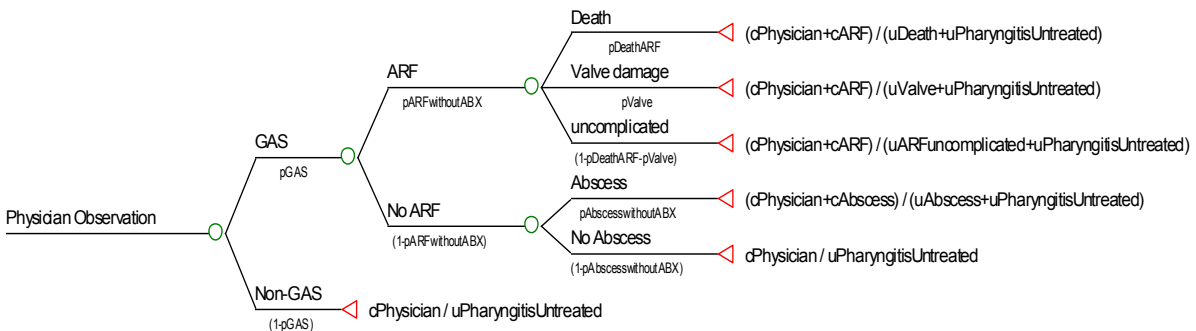
The following appendices depict the decision model used in the study.

Appendix A. GAS Sequelae Following Treatment



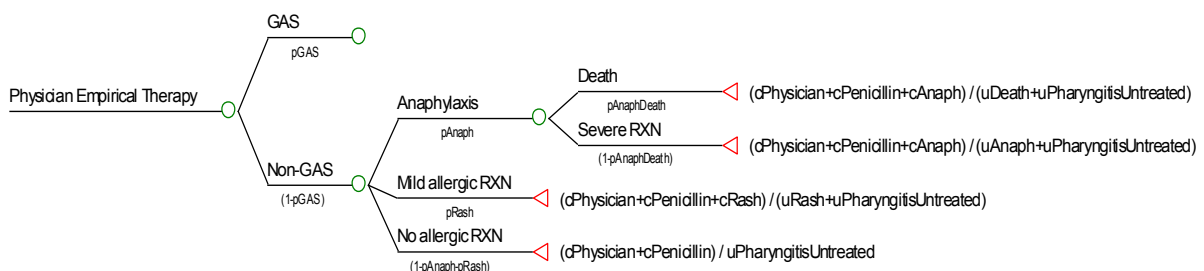
Appendix A shows the GAS sequelae following treatment, where  $c_{Provider}$  could represent treatment by a physician, pharmacist, or nurse practitioner in a walk-in clinic;  $c_{Test}$  could represent cRADT, cCulture, or no test if treated empirically; and  $u_{GAStreatedTest}$  could represent  $u_{GAStreatedRADT}$ ,  $u_{GAStreatedCulture}$ , or  $u_{GAStreatedEmpiric}$ .

Appendix B. Physician Observation



Appendices B-H show the 7 branches of the decision model. A triangle on the model represents a terminal node, whereas a circle following GAS would be followed by the tree shown in Appendix A.

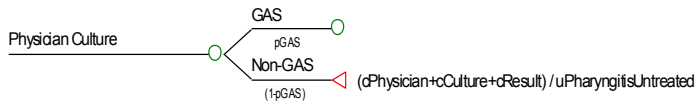
Appendix C. Physician Empirical Therapy



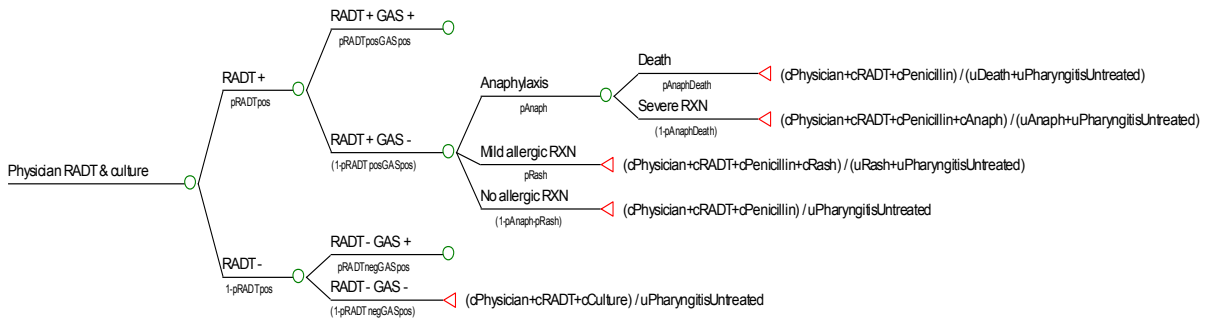


# Pharmacist-Provided Treatment of Adult Pharyngitis

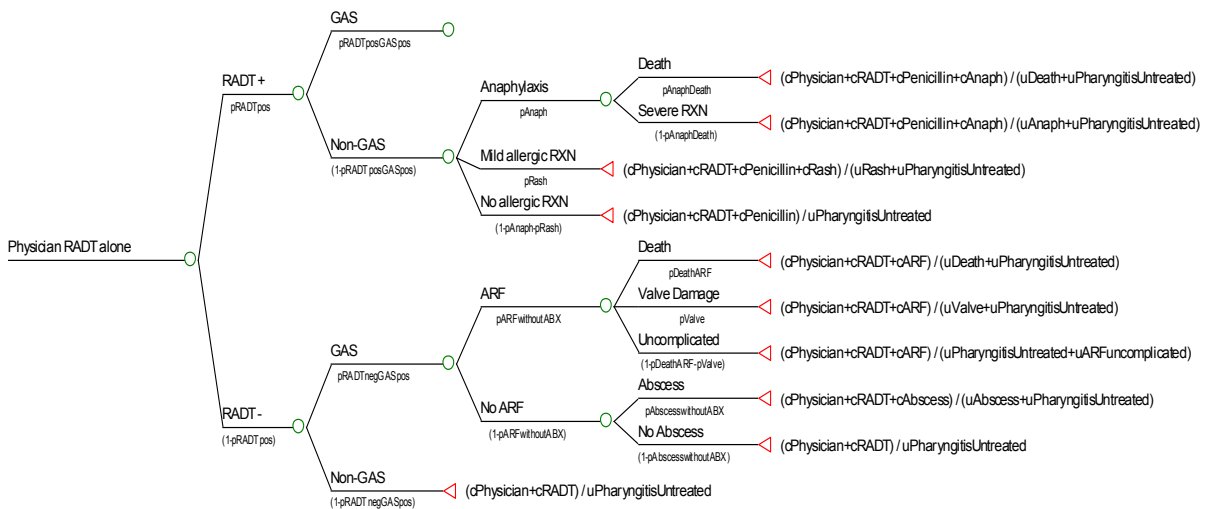
## Appendix D. Physician Culture



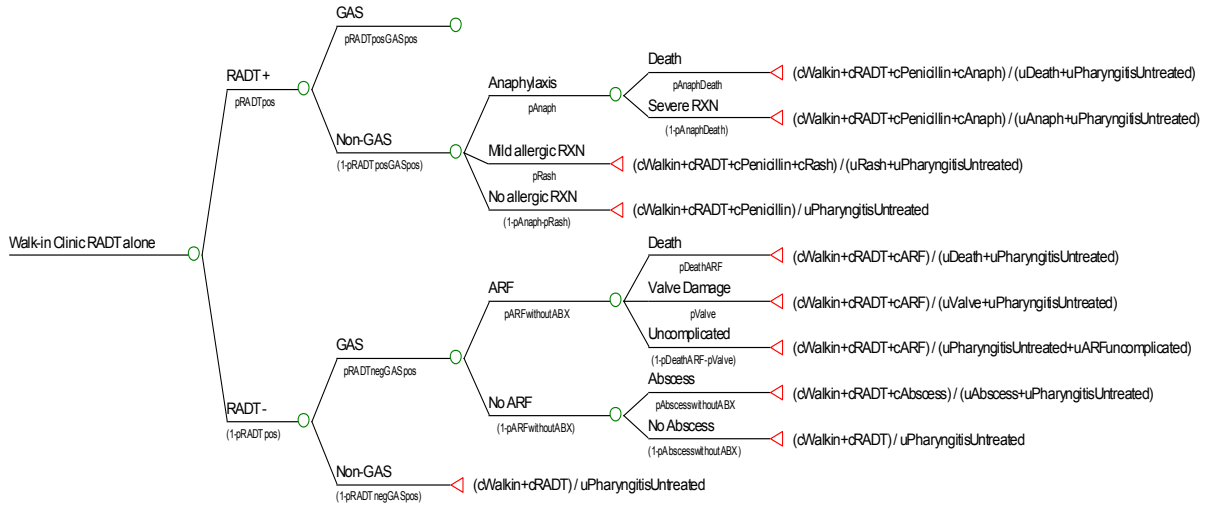
## Appendix E. Physician RADT and Culture if Results Negative



## Appendix F. Physician RADT Alone



Appendix G. Walk-in Clinic RADT Alone



Appendix H. Pharmacist

