Objective: To establish whether the results of a 2004 trial on the effectiveness of adenotonsillectomy in children with mild to moderate symptoms of throat infection or adenotonsillar hypertrophy affected physicians' beliefs about the benefits of the operation and influenced clinical practice.

Design: Prospective prior-posterior study.

Setting: Academic research.

Participants: We evaluated beliefs prior and posterior to the 2004 trial regarding the benefits of adenotonsillectomy in a random sample of 120 Dutch otolaryngologists and 120 Dutch general practitioners.

Main Outcome Measure: Physicians were asked to give their estimates of the probability of recovery during 1 year after adenotonsillectomy or a nonsurgical strategy in 3 scenarios of children aged 3 to 4 years with recurrent throat infection, upper respiratory tract infection (with or without fever), or sleep-related breathing disorder.

Results: Ninety-four percent of otolaryngologists (n=46) and 31% of general practitioners (n=14) were familiar with the 2004 trial results. Posterior beliefs of otolaryngologists and general practitioners did not differ substantially from prior beliefs; overall expectations regarding the benefits of adenotonsillectomy remained high.

Conclusion: Dissemination of the 2004 trial results did not seem to affect the beliefs of physicians regarding the benefits of adenotonsillectomy.

Trial Registration: isrctn.org Identifier: ISRCTN04973569

50 children randomized to watchful waiting underwent adenotonsillectomy, and 7 children randomized to adenotonsillectomy did not undergo surgery. Children in the adenotonsillectomy group had 2.97 episodes of fever per person-year vs 3.18 episodes in the watchful waiting group (difference, −0.21; 95% confidence interval, −0.54 to 0.12), 0.56 throat infections vs 0.77 (−0.21; −0.36 to −0.06), and 5.47 upper respiratory tract infections vs 6.00 (−0.53; −0.97 to −0.08). Sleep and eating patterns of children randomized to adenotonsillectomy initially improved more than those in children randomized to watchful waiting, but the differences had disappeared by 24 months. No clinically relevant differences were found for health-related quality of life. Adenotonsillectomy was more effective in children with a history of 3 to 6 throat infections than in children with 0 to 2. Twelve children had complications related to surgery. For children with mild to moderate symptoms of throat infection or adenotonsillar hypertrophy, it was concluded that adenotonsillectomy has no clinically relevant benefits over watchful waiting. The trial was funded by grant OG-99-060 from the Dutch Health Care Insurance Board.

METHODS

PRIOR AND POSTERIOR BELIEFS

We evaluated physicians’ beliefs regarding the benefits of adenotonsillectomy prior to (in 2002) and posterior to (in 2006) publication of the 2004 trial results. Publication occurred in 2 PhD theses and in national and international journals, and findings were presented at national and international meetings.

Random samples of 120 otolaryngologists and 120 general practitioners (GPs) were drawn from a list of approximately 400 members of the Netherlands Society of Otorhinolaryngology and Head and Neck Surgery and from a database that included approximately 9000 Dutch GPs. These samples were chosen based on the assumption that we needed at least 50 respondents in each group to obtain a precise point estimate and assumed a response rate of 50%. Both groups were contacted by mail and were asked to complete a structured questionnaire. Reminders were sent to all physicians after 4 and 9 weeks. All questionnaires were processed anonymously.

The questionnaire included 3 scenarios of children aged 3 to 4 years with recurrent throat infection, upper respiratory tract infection (with or without fever), or sleep-related breathing disorder. Respondents were asked to give their estimates of the probability of clinical improvement (in throat infections, fever episodes, and sleep) during 1 year after adenotonsillectomy or a nonsurgical strategy. Fever episodes were included in the questionnaire because most fever episodes in young children are caused by upper respiratory tract infections and because it was used as an objective outcome in the 2004 trial.

The probabilities were scored on a visual scale ranging from 0% to 100%.

To verify whether the 2004 trial results had been disseminated effectively among the respondents, the questionnaire included questions about their knowledge and acceptance of the trial results.

SCENARIOS

For each scenario, differences in physicians’ estimates of the probabilities of clinical improvement before and after dissemination of the 2004 trial results were tested using the Wilcoxon rank sum test, as the scores were not normally distributed. Differences in beliefs between otolaryngologists and GPs were also assessed.

Scenario 1

A 4-year-old girl visits her physician with symptoms of a sore throat and fever. Physical examination reveals enlarged and erythematous tonsils with crypt debris and a few tender cervical lymph nodes. She has a history of 4 throat infections with high fever during the past year, for which she has missed school for several days. Antibiotics have been prescribed on 2 occasions. She sometimes snores at night; she has no difficulty eating solid food.

Scenario 2

A 3-year-old girl is seen by her physician with a history of fever for several days and symptoms of rhinorrhea and coughing. She is a mouth breather, there are signs of rhinitis, and her tonsils are slightly enlarged but not inflamed. Several cervical lymph nodes are palpable. Otoscopy shows otitis media with effusion. She has had frequent upper respiratory tract infections with fever during the past year (6 episodes of the common cold), twice followed by an episode of acute otitis media. She has missed day care on many occasions. Her eating pattern is normal, as are her growth and development.

Scenario 3

A 4-year-old girl visits her physician with a history of restless sleep for 2 years. She snores heavily, and she sometimes seems to stop breathing during sleep. Her mother is worried because she has difficulty eating solid food. She has had 2 throat infections with fever during the past year. Physical examination reveals enlarged (almost “kissing”) tonsils. She breathes noisily through her mouth. A few cervical lymph nodes are palpable.

RESULTS

PRIOR BELIEFS

Of 120 otolaryngologists we approached, 76 (63%) returned a completed questionnaire, 6 (5%) indicated that they did not want to participate, and 38 (32%) did not respond to 2 reminders. Of 120 GPs we approached, 69 (57%) returned a completed questionnaire, 8 (7%) indicated that they did not want to participate, and 43 (36%) did not respond to 2 reminders.

We plotted the distributions of physicians’ personal estimates of the probability of clinical improvement in throat infections, upper respiratory tract infections, fever episodes, and sleep after adenotonsillectomy and after a nonsurgical strategy. These results are shown in Figures 1, 2, 3, and 4.

Median expectations of otolaryngologists regarding clinical improvement after adenotonsillectomy varied between 68% (upper respiratory tract infections in scenario 2) (n = 52) and 93% (sleep pattern in scenario 3) (n = 72). Median expectations regarding clinical improvement following a watchful waiting strategy varied between 18% (sleep pattern in scenario 3) (n = 14) and 38% (fever episodes in scenario 1) (n = 29).

Median expectations of GPs regarding clinical improvement after adenotonsillectomy varied between 36%
...after the trial (P<.001) and without T&Ads before the trial (P=.12) and after the trial (P<.001). GP indicates general practitioner; ORL, otolaryngologist.

Figure 2. Scenario 1. Four-year-old girl with recurrent throat infections. Distributions of physicians’ beliefs before and after the 2004 trial regarding the probability of recovery of throat infections after adenotonsillectomy (T&Ads) and a nonsurgical strategy (without T&Ads)—with T&Ads (P=.50 for ORL and P=.42 for GP) and without T&Ads (P=.25 for ORL and P=.93 for GP). Differences were assessed between ORL and GP regarding the expectations of improvement with T&Ads before the 2004 trial (P<.001) and after the trial (P=.01) and without T&Ads before the trial (P=.12) and after the trial (P<.001). GP indicates general practitioner; ORL, otolaryngologist.

Figure 3. A, Scenario 1. Four-year-old girl with recurrent throat infections. Distributions of physicians’ beliefs before and after the 2004 trial results regarding the probability of recovery of episodes of fever after adenotonsillectomy (T&Ads) and a nonsurgical strategy (without T&Ads)—with T&Ads (P=.25 for ORL and P=.28 for GP) and without T&Ads (P=.17 for ORL and P=.93 for GP). Differences were assessed between ORL and GP regarding the expectations of improvement with T&Ads before the 2004 trial (P<.001) and after the trial (P<.001) and without T&Ads before the trial (P=.03) and after the trial (P<.001). B, Scenario 2. Three-year-old girl with frequent upper respiratory tract infections. Distributions of physicians’ beliefs before and after the 2004 trial regarding the probability of recovery of episodes of fever after T&Ads and without T&Ads—with T&Ads (P=.02 for ORL and P=.63 for GP) and without T&Ads (P=.35 for ORL and P=.13 for GP). Differences were assessed between ORL and GP regarding the expectations of improvement with T&Ads before the 2004 trial (P<.001) and after the trial (P=.18) and without T&Ads before the trial (P=.74) and after the trial (P=.04). GP indicates general practitioner; ORL, otolaryngologist.

Scenarios. However, otolaryngologists had higher expectations regarding the benefits of adenotonsillectomy than GPs.

**POSTERIOR BELIEFS**

Of 120 otolaryngologists we approached, 49 (41%) returned a completed questionnaire, 17 (14%) indicated that they did not want to participate, and 54 (45%) did not reply to 2 reminders. Of 120 GPs we approached, 45 (38%) returned a completed questionnaire, 18 (15%) indicated that they did not want to participate, and 57 (47%) did not reply to 2 reminders.

The Table gives results of the knowledge, acceptance, and policy change rates among the participating otolaryngologists and GPs. Forty-six of 49 responding otolaryngologists (94%) and 14 of 45 responding GPs...
(31%) were familiar with the 2004 trial results on the
effectiveness of adenotonsillectomy in children, and
29% (n=14) of otolaryngologists and 82% (n=37) of
GPs agreed with the conclusions drawn from the trial.
Twenty-four percent (n=12) of otolaryngologists and
20% (n=9) of GPs indicated that they had changed their
policy regarding adenotonsillectomy. Some reported
that they referred (n=12) or operated on (n=13) more
children than before, whereas others reported that they
referred (n=16) or operated on (n=7) fewer children
than before.

Physicians’ expectations regarding clinical improve-
ment after adenotonsillectomy and after a nonsurgical
strategy varied considerably (Figures 1, 2, 3, and 4). Af-
ter dissemination of the 2004 trial results, expectations
of otolaryngologists and GPs regarding the benefits of
adenotonsillectomy remained high. Only in the scenario
of the girl with frequent upper respiratory tract infections
(scenario 2) did otolaryngologists have lower expecta-
tions after dissemination of the 2004 trial results than
before regarding clinical improvement of upper respira-
tory tract infections (60% after vs 69% before, P=.04) and
fever episodes (56% after vs 71% before, P=.01) follow-
ing adenotonsillectomy. The other estimates did not
change in either group of physicians.

Despite dissemination of the 2004 trial results that ad-
enetonsillectomy had no clinical benefits over a watch-
ful waiting policy in children moderately affected by throat
infections or symptoms of adenotonsillar hypertrophy,
overall expectations regarding the benefits of adenoton-
sillectomy in children remained high. Posterior beliefs
of otolaryngologists and GPs did not change relative to
prior beliefs. The overall expectations of otolaryngol-
ologists regarding the benefits of adenotonsillectomy re-
ained higher than the expectations of GPs.

These results agree with findings of a previous study.19
In that study, new evidence from a trial on the effects of
ventilation tubes did not change the beliefs of otolaryn-
gologists regarding the benefits of tubes on hearing and
language development.

Several barriers are known to influence the imple-
mentation of trial results, namely, external barriers and
lack of awareness, familiarity, and agreement.20 Most GPs
(69%; n=31) seemed to be unfamiliar with the 2004 trial
results, whereas most otolaryngologists (94%; n=46) were
familiar with them. However, 82% (n=37) of GPs who
were familiar with the results agreed with the conclu-
sions drawn vs only 29% (n=14) of otolaryngologists.
Therefore, unfamiliarity with and unwillingness to ac-
cept the trial results and its conclusions, as well as fa-
miliarity and willingness, may have had important roles
in our finding that physicians’ beliefs did not change.

Others have demonstrated wide variation in referral
rates for tonsillectomy or adenotonsillectomy and in in-
dications to perform this operation.21-27 Beliefs regard-
ing the effectiveness of adenotonsillectomy vary within
and between medical specialties. This may also have af-
ected implementation of the 2004 trial results.

![Figure 4. Scenario 3. Four-year-old girl with restless sleep. Distributions of physicians’ beliefs before and after the 2004 trial regarding the probability of improved sleep after adenotonsillectomy (T&Ads) and a nonsurgical strategy (without T&Ads)—with T&Ads (P=.02 for ORL and P=.07 for GP) and
without T&Ads (P=.82 for ORL and P=.52 for GP). Differences were assessed between ORL and GP regarding the expectations of improvement with T&Ads before the 2004 trial (P<.001) and after the trial (P<.001) and without T&Ads before the trial (P<.001) and after the trial (P<.001). GP indicates general practitioner; ORL, otolaryngologist.]

### Table. Knowledge, Acceptance, and Policy Change Rates Regarding Adenotonsillectomy Among Responding Otolaryngologists and General Practitioners (GPs) After Dissemination of the 2004 Trial Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Otolaryngologists, No. (%)</th>
<th>GPs, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changed practice regarding adenotonsillectomy</td>
<td>12 (24)</td>
<td>9 (20)</td>
</tr>
<tr>
<td>Changed policy was based on</td>
<td>Scientific literature</td>
<td>36 (73)</td>
</tr>
<tr>
<td>Conference information</td>
<td>24 (49)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Postgraduate education</td>
<td>16 (33)</td>
<td>17 (38)</td>
</tr>
<tr>
<td>Contacts with colleagues</td>
<td>24 (49)</td>
<td>13 (29)</td>
</tr>
<tr>
<td>Guidelines</td>
<td>5 (10)</td>
<td>20 (44)</td>
</tr>
<tr>
<td>Familiar with the 2004 trial results</td>
<td>46 (94)</td>
<td>14 (31)</td>
</tr>
<tr>
<td>Agreed with the conclusion of the 2004 trial</td>
<td>14 (29)</td>
<td>37 (82)</td>
</tr>
</tbody>
</table>

The question remains as to what methods might be suc-
cessful to implement a change in beliefs regarding the in-
dications for adenotonsillectomy. Unfortunately, there is
no evidence concerning which dissemination strategies are
likely to be effective under different circumstances.28 This
outcome calls for further research in this area.

Some limitations of this study should be mentioned.
First, the information included in the scenarios may have
been insufficient for physicians to make a meaningful
judgment. The information included was based on a pre-
vious inventory of the indications for adenotonsillec-
tomy in children among Dutch otolaryngologists and
GPs.20-31
Second, many otolaryngologists, especially from countries with a more restrictive policy regarding surgery in children with upper respiratory tract infections, would not operate in scenarios 1 and 3. However, our results show that most participating Dutch otolaryngologists and GPs expect more children to do better after surgery compared with watchful waiting, indicating that they refer and operate on these children.

Third, the high nonresponse rate may have resulted in biased probability estimates. It is possible that physicians with stronger beliefs regarding the benefits of adenotonsillectomy were more willing to respond than those who did not have such a strong opinion. However, a sensitivity analysis showed that the results only changed if the range of the prior distribution was much smaller. Even if all randomly selected otolaryngologists and GPs had completed the questionnaire, it is unlikely that such a small range would have occurred or that the results would have changed.

Fourth, because the same physicians were approached both before and after the 2004 trial, a strong positive within-individual correlation can be expected between beliefs before and after the trial. This would have resulted in a smaller variance than the variance used in the Wilcoxon test. Because the questionnaires were processed anonymously, we could not study the prior and posterior beliefs on an individual level, which would have had added value.

Fifth, in an attempt to find more objective clues about how to interpret the incongruence between trial results and posterior beliefs, we calculated the yearly incidence of adenotonsillectomy. Strikingly, we found a slightly decreased incidence of adenotonsillectomy between 1998 and 2006. However, it is unlikely that this decrease is because of the publication of the 2004 trial results. Only an extra trend toward a reduction in the number of adenotonsillectomies could be owing to dissemination of the 2004 trial results, but such an extra reduction has not occurred. However, it is possible that other studies with similar outcomes (eg, the 2002 study by Paradise et al?) affected the outcome. Seventy-three percent (n=36) of participating otolaryngologists reported that they had changed their policy on the basis of scientific publications; however, most of them reported that they performed adenotonsillectomy more frequently.

In conclusion, dissemination of the 2004 trial results did not affect the beliefs of physicians regarding the benefits of adenotonsillectomy. Therefore, the adoption of research evidence in clinical practice remains a complex process.

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Author Contributions: All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Rovers, Klinkhamer, and Schilder. Acquisition of data: Rovers and Klinkhamer.

Analysis and interpretation of data: Rovers, Hoes, Klinkhamer, and Schilder. Drafting of the manuscript: Rovers and Klinkhamer. Critical revision of the manuscript for important intellectual content: Rovers, Hoes, and Schilder. Statistical analysis: Rovers and Klinkhamer. Obtained funding: Schilder. Administrative, technical, and material support: Klinkhamer. Study supervision: Hoes and Schilder.

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