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Cost-Utility of Repeated Screening for Chlamydia Trachomatis

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ABSTRACT

Objective: To estimate the cost-effectiveness of repeated screening for chlamydia trachomatis at various time intervals compared to one-off screening of Dutch young adults.

Methods: We used a dynamic model to fully take the spread of the disease over time in the population into account, with data being used gathered within the context of a recently performed pilot study in The Netherlands. The screening frequencies analyzed were: every year, every 2 years, every 5 years, and every 10 years. The strategies were compared in terms of incremental cost-effectiveness, expressed as the net costs per quality-adjusted life-year (QALY).

Results: For all interval strategies, with the exception of screening every year, incremental cost-effectiveness stays below the informal Dutch threshold of €20,000 per QALY.

Conclusion: From a health-economic point of view, for the Dutch situation, we estimated screening every 2 years as the optimal strategy among the options investigated.

Keywords: chlamydia trachomatis, cost-utility analysis, dynamic model, screening.

Previously we estimated the cost-effectiveness of a systematic chlamydia trachomatis (CT) screening program for a young Dutch adult, which recently has been published in this *Value in Health* [1]. This analysis concerned an initial one-off screening, without any subsequent repeated screenings assumed. We used a dynamic model to fully take the spread of the disease over time in the population into account, with data being used that were gathered within the context of a recently performed pilot study in The Netherlands [2]. We showed that, in baseline analysis, the prevention of one major outcome as a result of the screening program costs €373 for the Dutch situation. Here, symptomatic pelvic inflammatory disease, chronic pelvic pain, ectopic pregnancy, infertility, and neonatal pneumonia were considered major outcomes and were aggregated into one figure.

The frequency of subsequent screening is a logical topic of discussion before implementation of such a program. Hence, in this article we present additional research on the cost-effectiveness of repeated systematic screening at various time intervals compared to the one-off screening presented before. Furthermore, as among many other countries, in The Netherlands interventions are valued with respect to the cost per quality-adjusted life-year (QALY), we linked quality weights to the complications related to CT-infections to enable such estimates of the costs per QALY. In The Netherlands, interventions are considered cost-effective if cost-effectiveness is estimated below a threshold of €20,000 per QALY [3]. This threshold is informal and certainly not undisputed, but often used by decision-makers.

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Methods

Model

We used a deterministic SIS (Susceptible-Infected-Susceptible) model to estimate the impact of the screening program on the incidence and prevalence of CT in the population [4]. We followed a heterosexual population of 100,000 men and women with a sex ratio 1:1 and a uniform age distribution over 15–29 years. The population was divided according to sex, sexual activity, and condition (susceptible, symptomatically infected, or asymptomatically infected). We used the output of the dynamic model as input for a progression-of-disease tree to calculate the number of complications and associated costs related to a specific incidence. The dynamic model, progression-of-disease tree, and the parameter values used are described in detail in the research previously published [1]. In this analysis, we made the same assumptions as we did in the baseline analysis of that research. Nevertheless, instead of a time horizon of 10 years, a time horizon of 20 years was used to fully acknowledge the dynamics of repeated screening at different time intervals.

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Screening Strategies

The systematic screening program targeted 15- to 29-year-old men and women and included (partner) treatment [1,2]. We compared the one-off screening with repeated screening on various time intervals. The screening frequencies analyzed were: every year, every 2 years, every 5 years, and every 10 years. We modeled the screening from t = 0 to t = 10 years (e.g., screening every 5 years was modeled on t = 0, t = 5, and t = 10 years). The period of t = 10 years to t = 20 years was included to fully grasp the long-term effects and financial benefits of the screening programs, inclusive the full effects of any screening at t = 10 years. As in the previous article, we assumed that the infection reached endemic equilibrium before the implementation of the screening program. Furthermore, we assumed that the participation rate was constant over time (47% of the women and 33% of the men [1,2]).

Cost-Effectiveness Analysis

We expressed cost-effectiveness as the net costs per QALY. We linked quality weights to the health states related to the complications of both symptomatic and asymptomatic CT-infections. The quality weights together with their durations were based on the Health Utility Index and were obtained from a study commissioned by the Institute of Medicine [5]. The perspective of the analysis was that of the society: both direct medical costs and indirect costs of production losses were included. The cost estimates are fully described in the previous research [1]. Future costs and future complications were discounted at a rate of 4% per year according to Dutch guidelines for pharmacoeconomic research [6].

Results

The estimated costs and QALYs for the different screening strategies are presented in Table 1 and Figure 1. Within a time frame of 20 years, the cost of the one-off screening program (€1,212,778) is totally offset by the averted cost of €1,434,056. Repeated screening on various time intervals leads to both an increase in QALYs gained and total net costs. Obviously, the higher the frequency the more QALYs are gained. Nevertheless, this increase in QALYs is accompanied by an increase in the net costs per QALY. The appropriate comparison between mutually exclusive programmes, in that if one strategy is implemented the others will not, is in terms of the incremental cost-effectiveness [7]. Therefore, in Table 1 the incremental costs-effectiveness ratios (ICERs) are calculated for each successive alternative, from the least costly to the most. In Figure 1, the ICERs are given by the slope of the line joining any two points (alternatives). Here, a 10-year screening strategy is eliminated because of extended dominance, as its ICER is higher than that of the next more effective treatment (screening every 5 years). After exclusion of the dominated strategy, the recalculated ICER for a 5-year screening strategy is €1793 per QALY. For all interval strategies, with the exception of screening every year, incremental

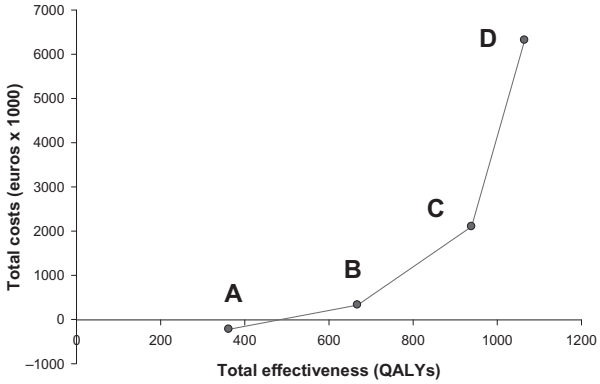

Figure 1 Total costs and effectiveness of the different chlamydia trachomatis screening strategies, where A = one-off, B = every 5 years, C = every 2 years, and D = every year. The incremental cost-effectiveness ratios are given by the slope of the line joining any two points. QALY, quality-adjusted life-year.

Table 1 Outcomes of the different screening programs for a population of 100,000 persons (costs in 2002 euros)

Strategy	Costs	QALYs	ICER*
One-off	–221,278	362	–611
Every 10 years	33,131	501	Dominated†
Every 5 years	327,625	668	1,793
Every 2 years	2,099,562	939	6,539
Every 1 year	6,316,683	1,065	33,469

*ICER is calculated for each successive alternative, from the least costly to the most.
†A strategy is dominated as its ICER is higher than the next more effective treatment.
ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.

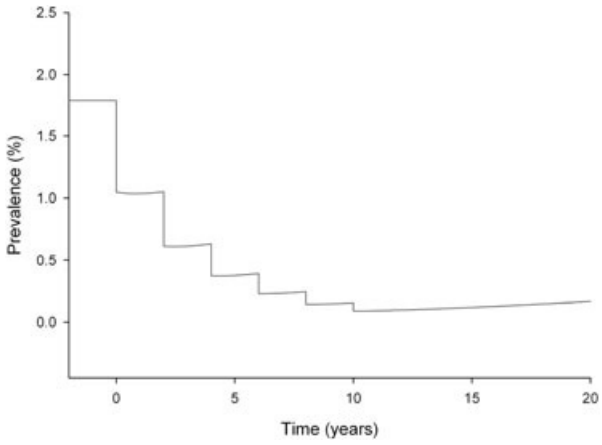

Figure 2 Chlamydia trachomatis prevalence in the whole population as a result of screening every 2 years (t = 0, t = 2, t = 4, t = 6, t = 8, and t = 10).

cost-effectiveness stays below the informal Dutch threshold of €20,000 per QALY. For illustrative purposes, the reduction in CT-prevalence as a result of screening every 2 years is depicted in Figure 2. The overall prevalence drops from 1.79% at steady state to a minimum of 0.09% after the last screening (t = 10), after which the prevalence slowly increases again as a result of the (somewhat restricted) mixing within and between the different sexual activity groups.

Discussion

Application of our dynamic model shows that the one-off systematic screening program is estimated cost-saving within a time horizon of 20 years. It is obvious that shortening the time horizon is accompanied by a decrease in averted complications and associated costs. For example, as in our previous research, within a time horizon of 10 years the program costs are not fully off-set by the averted costs (one has to pay €373 per major outcome averted) [1]. Ideally, the time horizon should be a population's entire lifetime, but as various influencing factors may change during that period and could lead to invalid results, one should choose a reasonable time horizon to produce plausible results. As in the previous research, we opted for a period of 10 years after the last screening in any of the strategies investigated, which was at t = 0 for the previous article and t = 10 in the current one. The latter implies a full period of analysis with a time horizon of 20 years to take the effects of repeated screening strategies into account.

Even though repeated screening leads to an increase in QALYs gained, society has net to pay for the prevention of CT-complications. The influence of the prevalence on the cost-effectiveness of a CT-screening program is clearly shown in Table 1; as the frequency of screening is decreased, the prevalence is able to return to a higher level before the next screening starts and so relatively more complications (and associated costs) can be averted per screening. For example, of all strategies screening every year will avert most complications, but the price one has to pay per QALY is highest as well. So, among other things it depends on the decision-maker's willingness to pay which program should be implemented. We assume the participation rate remains the same every year. Nevertheless, it could be possible that this rate drops as the frequency increases.

In conclusion, from a health-economic point of view, the objective is to choose the strategy that gains the maximum number of QALYs with the cost-effectiveness threshold as constraint. So, irrespective of other concerns (e.g., feasibility) of the examined strategies, we estimated screening every 2 years as the best option for the Dutch situation given the informal threshold of €20,000 per QALY. We note that other—not yet investigated—strategies, such as men and women tested negative are screened every 2 years and those tested positive are screened every 6 months, could be cost-effective alternatives as well. Further research on the cost-effectiveness of such alternative strategies is required.

References

1 de Vries R, van Bergen JEAM, de Jong-van den Berg LTW, Postma MJ. Systematic screening for chlamydia trachomatis: estimating cost-effectiveness using dynamic modeling and Dutch data. Value Health 2006;9:1–11.
2 van Bergen J, Götz H, Richardus JH, et al. Prevalence of urogenical chlamydia trachomatis increases significantly with level of urbanisation and suggests targeted screening approaches: results from the first national population-based study in The Netherlands. Sex Transm Infect 2005;81:17–23.
3 Bos JM, Postma MJ. Using pharmacoeconomics for policy making: is rational decision making enhanced by applying thresholds for cost-effectiveness? Expert Rev Pharmacoeconomics Outcomes Res 2004;4:247–50.
4 Anderson RM, May RM. Infectious Diseases of Humans: Dynamics and Control. Oxford: Oxford University Press, 1991.
5 Appendix 2: Chlamydia. In: Stratton KR, Durch JS, Lawrence RS, eds. Vaccines for the 21st Century: A Tool for Decisionmaking. Washington, DC: National Acad Press, 2000.
6 Riteco JA, De Heij LJM, van Luijn JCF, Wolff I. Guidelines for Pharmacoeconomic Research (in Dutch: Richtlijnen Voor Farmaco-Economisch Onderzoek). Amstelveen: College voor Zorgverzekeringen, 1999.
7 Weinstein MC. Principles of cost-effectiveness resource allocation in health care organizations. Int J Technol Assess Health Care 1990;6:93–105.