

RAPID REVIEW

Economic Benefits of Smoking Cessation Interventions

This response addresses the question: What is the recent review-level evidence on the economic benefits of smoking cessation interventions?

Key Findings

- This rapid review examines the economic benefits of smoking cessation interventions.
- A variety of intervention types have been evaluated for economic benefits including: pharmacological interventions; behavioural interventions; provision of financial assistance; combined pharmacological and behavioural interventions; community-based pharmacy support; community-based group cessation classes; internet-based interventions; and mass media led interventions.
- Five recent systematic reviews were included and overall most smoking cessation interventions showed economic benefits across a range of measures: e.g., cost per successful quit attempt, cost per additional quitter, and cost per quality adjusted life year (QALY) gained.
- Included systematic reviews rated moderate to strong in the methodological quality of their syntheses. However, the economic analyses used to generate the outcomes that the reviews reported varied in the quality of their methods and in the transparency of their reporting.
- It was not feasible to combine data for intervention types, given the variation within the literature reviewed (e.g., different interventions, intervention type, time horizons, and ways to define outcome measures). The available literature reports a host of considerations when interpreting these reviews' findings for decision making.

Background

The Canadian Community Health Survey (CCHS) 2017 data indicates that 15.4% (95% CI: 14.5-16.3) of Ontarians ages 12 and older reported current smoking (daily or occasional use).¹

Cigarette smoking causes a number of preventable diseases and has significant related healthcare costs.² Based on recent estimates for 2018, smoking cost Ontario \$2.7 billion in direct healthcare costs and 4.2 billion in indirect costs, for a total of almost \$7.0 billion.³⁻⁵

Current smokers cost the healthcare system more than never and former smokers, particularly at older ages.² For example, in Ontario, between 2005 and 2013, a 70 year-old never smoker is estimated to cost the healthcare system \$4564 annually compared to \$9494 for a 70 year old current smoker.²

Reducing smoking prevalence can save dollars: Manuel et al., determined that \$4.2 B was saved due to reduced healthcare costs associated with reductions in tobacco prevalence in Ontario over a ten year period.⁶

Understanding which interventions demonstrate economic benefits can help public health practitioners make the case for investments that support cessation and may contribute to reducing healthcare costs. “Reach” of cessation interventions is an important consideration in achieving population level impact.⁷ To achieve population impacts, interventions need to be delivered with sufficient reach and intensity and sustained over time.⁷

Methods

A rapid review of published literature was conducted to synthesize recent review level research evidence on the economic benefits of smoking cessation interventions. A rapid review is a form of knowledge synthesis based on the steps of a systematic review,⁸ making certain adjustments to those steps in order to be timely.⁹ A rapid review can respond to questions similar to those that a systematic review can answer. Considering scope, feasibility and the need for responsiveness, a rapid review was the chosen approach to systematically review the recent evidence.

To identify relevant evidence, systematic searches were conducted on December 17, 2018 for the above research question. PHO Library Services conducted a search in MEDLINE, Embase, CINAHL, SocINDEX, EconLit, and NHSEED, using relevant vocabulary and subject headings. All database results were integrated, and duplicates removed. The search strategy is available upon request.

English-language peer-reviewed review level papers were eligible for inclusion if they included outcomes related to economic evaluation of smoking cessation interventions and were published between 2015 and December 2018.

One reviewer screened titles and abstracts, and then full-text versions of all papers for inclusion. The reviewer confirmed with a second reviewer when clarification was needed. A total of five papers were identified for this rapid review of reviews.¹⁰⁻¹⁶

For all relevant papers, one PHO staff extracted relevant data and summarized content.

Quality appraisal was conducted for each included review using the HealthEvidence.org Quality Assessment Tool for Review Articles.¹⁷ Two reviewers made independent assessments for each of the ten quality criteria. Any discrepancies were resolved by discussion. Guided by quality appraisal results, narrative statements describing the strengths and weaknesses are reported.

In addition, the reviews were assessed in terms of whether they described their analysis clearly, and made their assumptions explicit, using economic analysis criteria¹⁸ and reporting guidance¹⁹ as a reference.

This response describes the smoking cessation intervention(s), perspective chosen for analysis, reported outcomes, and major findings of the included studies. Due to the different approaches and their methodological features, each review is described separately, in order of quality.

Findings

Description of the Literature

The peer-reviewed literature search identified 260 articles, of which five met inclusion criteria.^{10-12,14,15} All included papers were systematic reviews. These five included reviews reported findings from 188 primary studies. We did not assess overlap of primary studies across the five included reviews. The number of included studies within these reviews (that focused on cessation) ranged from two¹⁴ to 151.¹²

Smoking cessation interventions reported in the literature included: pharmacological interventions (e.g., varenicline, nicotine replacement therapy), behavioural interventions (e.g., behavioural support provided by group counselling, computer tailored interventions), financial interventions (e.g., direct coverage for cessation services for both patients and/or healthcare providers), and mass media led interventions.

This review focused on the economic benefits of cessation, and assessed the value of an intervention in terms of outcomes relative to the costs.¹² These studies may be looked at in absolute terms, or preferably, in an incremental way in comparison to another intervention (i.e., incremental cost-effectiveness ratio).¹² For the purpose of this review, we use the term economic benefits as an umbrella term to describe the scope of our results.

A variety of outcomes were reported among the five included reviews. For example, cost per successful quit attempt, cost per Quality Adjusted Life Year (QALY) gained, healthcare costs avoided, and cost effectiveness. A quit was defined in various ways; for example, van den Brand et al., included studies where quitting meant not smoking for at least 24 hours and abstinence meant not smoking for six months after the intervention, with biochemical validation. Ali et al., used the terms abstinence and quits interchangeably and reported seven-day point prevalence (PP) measures, which were either self-reported or biochemically validated. Most studies reported cost-effectiveness of cessation interventions in comparison to another cessation intervention. No studies reported return on investment or cost-benefit analysis.

The results are reported below in a narrative form with the strongest quality review summarized first, followed by the moderate quality reviews in turn. While some of the outcomes were common across papers, they could not be described collectively due to the varying interventions, analytic methods, and approaches. The data extraction for the five included reviews is available upon request.

Quality of Included Reviews

Relevant reviews rated moderate¹⁰⁻¹⁴ and strong in methodological quality¹⁵ based on the HealthEvidence.org Quality Assessment Tool for Review Articles.¹⁷ Included reviews showed some consistent weaknesses: lacking a comprehensive search strategy, not reporting quality assessment for included studies and therefore not having two reviewers appraise quality, as well as not appropriately weighting findings due to lack of quality appraisal. A table showing quality scoring for individual criteria across the five included reviews is available upon request.

A variety of analyses were done for the included reviews. Comments on the completeness and quality of methods, use of quality criteria and assessment of underlying assumptions, and completeness of reporting are available separately upon request.

Results of Economic Evaluations

VAN DEN BRAND (2017) – This strong-quality Cochrane systematic review reported the results of eight cost studies on **providing full financial vs partial financial assistance** to those 18 and older **trying to quit smoking**. Examples of financial assistance for individuals were free pharmacotherapy from a trial or insurance coverage for behavioral support. When all cessation treatment costs were covered for an individual, that was full assistance, compared to partial. The review showed full financial assistance was more cost-effective than provision of either partial or no financial assistance on either costs per additional quitter or costs per quality-adjusted life years.

The review also assessed the provision of financial assistance to providers (as opposed to smokers themselves). These were typically payment for specific care (capitation) or fee for service. Overall, these studies did not show clear evidence of an effect on smoking cessation.

Definitions of full and partial assistance were not standardized across the included primary studies. This review assessed quality of the included studies specifically based on established health economic criteria and reports in a detailed and systematic way for all included studies. The review reported on two cost-relevant outcomes:¹⁵

- Costs per additional quitter: Eight included studies examined full financial benefit provided to the smoker compared to partial or no financial benefit. Provision of the benefit direct to the smoker was in the form of health insurance coverage (level of benefit), healthcare costs (direct), or the cost of premiums for health insurance. Costs per additional quitter ranged from 97 USD to 7,646 USD. This review did not detect an effect for financial assistance interventions aimed at providers (three studies).
- Costs per quality-adjusted life years (QALY) gained: A QALY incorporates intervention effects on both length and the quality of life. One study included in this review provided mean cost data per additional QALY, reporting 2,342 USD. In general, a cost-effectiveness threshold is 50,000 USD per QALY gained, which was considered along with other comparable thresholds in a recent systematic review of methods in the estimation of these thresholds.²⁰ The review also assessed willingness to pay, an approach based on an assumption of a fixed healthcare budget where each new intervention, if not cost saving, will necessarily displace some existing services and cost per QALY of that new intervention should be lower, compared with the displaced services.²¹ The authors of this review projected that at a level of 12,990 USD for an additional 12-month quitter, there would be a 95% probability that reimbursement for smoking cessation treatment would be cost effective.

ALI (2018) – This moderate-quality review included 22 studies. The review assessed cost-effectiveness measured as cost per quit, comparing across **pharmacological and behavioural interventions (and both combined), for smokers not ready to quit (SNRTQ)**. Cost-effectiveness of interventions was assessed only for cigarette smoking (excluding smokeless tobacco, snus and e-cigarettes), and using only studies with biochemical validation (15 of 22 studies).¹⁰ The review authors calculated the costs based on primary study data, making the parameters of their analysis transparent; however, there was no quality appraisal of the primary studies, nor were the assumptions and key details of the economic analysis (discount rate, time horizon, etc.) reported thoroughly.

- Cost per quit by intervention type, smokers not ready to quit:
 - The pooled cost per quit for pharmacological interventions was 19,510.24 USD.
Pharmacological interventions for SNRTQ using varenicline showed the lowest pooled
- Economic Benefits of Smoking Cessation Interventions

cost per quit at 10,688.05 USD (Table 2 of publication). There were no available data for comparing cost per quit for SNRTQ and smokers ready to quit.

- Behavioural interventions: Pooled cost per quit for behavioural interventions for SNRTQ was 11,415.74 USD. The authors state that this pooled cost for SNRTQ is much higher than for smokers ready to quit based on published estimates from other studies of 1,807.00 – 3,326.40 USD, in 2016 USD. The authors propose the increased cost for SNRTQ may be due to intervention intensity required for those not yet ready to quit.
- Combined pharmacological and behavioural interventions: Pooled cost per quit was 14,662.36 USD. There were no available data to compare combined pharmacological and behavioural interventions for SNRTQ and smokers ready to quit.
- Cost-effectiveness: Overall, Ali et al., reported that behavioural interventions showed the greatest cost-effectiveness, compared to both pharmacological and combined pharmacological and behavioural interventions, based on pooled cost per quit. The included papers defined quits in a variety of ways (point prevalence abstinence, continuous abstinence of greatly varying time frames from 7 days to 10 weeks to one paper that defined quit as continuous abstinence over 6 months). Pharmacological interventions and combination interventions each showed greater overall impact on cessation rates, but were lower in cost effectiveness based on cost per quit.

PELETIDI (2016) – This moderate-quality review synthesized results of two cost-effectiveness studies of **pharmacy-led interventions compared to group counselling**. One study compared pharmacy-based, individual support once per week in combination with nicotine replacement therapy (NRT) to group counselling and medication; the second study described in the review compared one-to-one counselling with a pharmacist to group-based support.¹⁴ Both UK-based studies compared a pharmacy-led intervention, with one taking place over four weeks and the other intervention taking place over twelve weeks. This review has a moderate-quality, systematic process for synthesis but was not as systematic in the appraisal and reporting of the economic analyses.

- Cost per client: In both studies reviewed narratively, pharmacy-led services reported lower costs per client (£53.31 and £79.20, respectively) compared to group-based services (£338.54 and £368, respectively). While group-based counselling was more effective than pharmacy-based support, it was not as cost-effective (average cost-effectiveness).
- Incremental cost per quitter: In the first study, pharmacy-led services reported lower incremental costs per quitter over the four week program (£772) compared to the group-based service (£1,612). Likewise, the second study reported that pharmacy-led services required lower costs per additional quitter of £7,800 for its 52-week program, whereas the group-based service required £9,200 per additional quitter.
- Incremental cost per QALY: Only the second of the two studies reported an incremental cost QALY, which was £2,600 for the pharmacy-led group and £4,800 for the group-based service.

CHEUNG (2018) – This moderate-quality review was based in the Netherlands. They utilized their meta-analysis results of five internet-based intervention studies to model the cost-effectiveness of **adding an internet-based intervention to current services for smoking cessation**. To assess economic value, the EQUIPTMOD return on investment tool was used. Cheung et al., included only internet-based interventions that followed up for at least 12 months, and excluded prevention and lifestyle interventions that did not focus on smoking cessation.¹¹ This review specified time horizons over which

analyses were done, and included a sensitivity analysis. No quality appraisal was done for the primary studies included in this moderate-quality review; however, the review did apply sensitivity analyses and detailed reporting of key economic evaluation details (time horizon, discount rates).

- **Costs per smoker:** for the internet-based intervention, costs per smoker were calculated at €2.71; and a reach of 0.41% of all smokers.
- **Dominance:** Provision of an internet-based intervention along with the current package of cessation interventions was dominant for all time horizons compared to the current package alone, with the provision of internet-based interventions offering 0.14 QALYs gained per 1000 smokers, and reduced healthcare costs of €602.91 per 1000 smokers (lifetime horizon).

EPKU (2015) – This moderate-quality review synthesized findings from 151 studies, with minimal cost-effectiveness analyses across a **range of intervention types**. Their narrative synthesis is not transparent in terms of the number of studies synthesized for each economic outcome reported. Despite the broad scope and high volume of published literature in their review, Epku et al., caution that since most evaluations were not over the long term, the long-term benefits of interventions remain uncertain. The challenge is that intervention benefits are based on returning to non-smoker risk-status, but most of these benefits are estimates.²²⁻²⁶ As well, some cost estimates come with high risk of uncertainty (e.g., where sensitivity analysis show that estimates are sensitive to variation in discount rates and quit rates). The review authors also note there are meaningful differences in the costs of smoking and smoking-related diseases across countries, which factor into their analyses.¹² Quality appraisal and reporting were done for the review in a narrative manner but are not approached consistently for all included papers, possibly due to high volume and feasibility of providing the associated assessment data. While the review reported details for multiple studies to which they refer, we report here the studies included in their synthesis, for which the research evidence is transparent.

- NHS Smoking cessation treatment services:
 - National Health Services (NHS) specialist treatment services (not defined) have been estimated by The National Institutes of Clinical Excellence (NICE) to be approximately £3,000 per life year gained and approximately £2,000 when adjusted using UK discount rates. In a separate study, these specialist smoking cessation services (not defined in terms of what that entailed) were reported to generate a cost of less than £800 per life year saved, and total costs of £21.4 million or £209 per patient treated.
 - Pharmacological relapse prevention via nicotine replacement therapy (NRT), bupropion, and varenicline were shown in two studies to be both clinically meaningful and cost effective. Compared to no intervention, bupropion resulted in an incremental QALY increase of 0.07 with cost savings of £68 per patient to the NHS. NRT and varenicline both generated incremental QALY increases for a total of £265 and £2106 per QALY gained.
- Community-based pharmacist smoking cessation interventions reported cost per life year saved ranging from £196.76 to £351.45 in men and from £181.35 to £772.12 for women (1997 values reported). A separate study comparing pharmacy support vs. group-based support reported that incremental cost per four week quitter for the pharmacy-based support was £772 and for the group-based support cost per four-week quitter was £1,612. For the same study, the incremental cost per QALY was £4,400 for pharmacy-based support and £5,400 for group support. This result overlaps with the data reported for cost per quitter above in Peletidi et al.

- Heart Beat Wales (HBW) was a no smoking intervention carried out 1985-1988. Outcomes included reduction in smoking prevalence and reduced morbidity. The “economic” appraisal values the net present benefits at £43,503,000, and the estimated cost per working life year saved is £5.78. The review reports that the net costs per life year saved means that the program generates additional working life years at a relatively low cost.
- Mass-media led interventions were explored in two studies. After twelve months, one campaign with three elements (mass media advertising, free telephone quitline, and handbook to support smokers in cessation) reported cost per quitter estimates ranging £189 to £369, with costs per life year saved attributable to the campaign from £304 to £656.
- No smoking day held in the UK is a national awareness campaign aimed at facilitating an environment in which smokers can quit. The cost of this day is £0.088 per smoker. Discounted life years gained per smoker in the 35-44 age group was 0.00107, generating an incremental cost-effectiveness ratio (ICER) of £82.24 per life year gained (95% CI 49.7-231.6). As a result, this campaign is considered both effective and cost-effective for smoking cessation.
- School-based and work-based programs both showed net cost savings and overall health benefits suggesting a dominant scenario (better outcomes and cost savings).

Conclusion

Overall, smoking cessation interventions demonstrated economic benefits across a range of measures including cost per quit, cost per additional quitter, and cost per QALY gained. The available review-level literature evaluated a variety of intervention types including provision of financial assistance; pharmacological interventions; behavioural interventions; combined pharmacological and behavioural interventions; community-based pharmacy support; community-based group cessation classes; internet-based interventions; mass media led interventions.

Some interventions found to be highly effective (i.e., clinically) were reported to be less cost-effective compared to an alternative intervention, due to the cost per quitter being greater than that of the comparison intervention. For example, pharmacological interventions (varenicline, bupropion) are shown by Ali et al., to be less cost-effective compared to behavioural interventions alone, or to behavioural interventions and pharmacotherapy combined. The available literature reports a host of considerations when interpreting these reviews’ findings for decision making.

Limitations of the Literature

Economic outcomes may vary depending on healthcare system financing, economy, and jurisdiction, as examples. Findings should be considered in new settings with attention to their appropriate application. The included reviews report a variety of different cost measures in USD, Euros, and Great Britain Pounds, and applying a range of inputs, assumptions and parameters.

The quality of primary literature on cost effectiveness should be considered. The only review that appraised quality of the primary studies noted that quality of the primary literature was generally low, meaning that in some studies, costs may not have been identified, measured, or valued properly.¹⁵ While not undertaking formal quality appraisal, other authors of included studies noted some estimates showed a high degree of uncertainty.¹² In general the longer the time horizon the more uncertainty as these outcomes are generally modeled, and the modeling assumptions can have large effects on the ICER.

The application of health economic quality criteria and reporting standards were followed in only one of the five included reviews. Assumptions were not explicit, and context and perspectives lacked transparency. This adds to the difficulty in comparing and interpreting the economic data.

Issues of equity, needs and priorities were not a focus of the included reviews.

There was inconsistency in the definition and assessment of parameters across analyses. Most analyses were done in the short term only, and discount rate and time horizons were not consistently described in the reviews.

Funding sources were reported in four of the five included reviews and were not a limitation at the synthesis level. Likewise, in terms of conflicts of interest, only one review reported previously-held (2009) funds from Pfizer and within the same review; another author had a trial included in the earlier version of that review. It was outside the scope of this rapid review to gather and assess conflicts of interest and funding sources for the primary studies included in the five reviews.

References

1. 2017 Canadian Community Health Survey (CCHS) Data (Current Smoking). 2018 Dec 14.
2. Zhang B, Chaiton C, Dubray J, Schwartz R. Direct healthcare cost by smoking status among Ontario adults [Internet]. Toronto, ON: Ontario Tobacco Research Unit; 2018 [cited 2019 Dec 4]. Available from: http://otru.org/wp-content/uploads/2018/11/react_project_news_nov2018.pdf
3. Dobrescu A, Bhandari A, Sutherland G, Dinh T. The costs of tobacco use in Canada, 2012. Ottawa, ON: The Conference Board of Canada; 2017.
4. Ontario Tobacco Research Unit. Smoke-free Ontario strategy monitoring report. Toronto, ON: Ontario Tobacco Research Unit; 2018. Available from: https://otru.org/wp-content/uploads/2018/03/2017_SMR_Full.pdf
5. Cancer Care Ontario; Ontario Agency for Health Protection and Promotion (Public Health Ontario). The burden of chronic diseases in Ontario: key estimates to support efforts in prevention. Toronto, ON: Queen's Printer for Ontario; 2019. Available from: <https://www.ccohealth.ca/sites/CCOHealth/files/assets/BurdenCDReport.pdf>
6. Manuel DG, Perez R, Bennet C, Laporte A, Wilton AS, Gandhi S, et al. A \$4.9 billion decrease in health care expenditure: the ten-year impact of improving smoking, alcohol, diet and physical activity in Ontario [Internet]. Toronto, ON: Institute for Clinical Evaluative Sciences; 2016 [cited 2019 Jan 7]. Available from: <https://www.ices.on.ca/Publications/Atlases-and-Reports/2016/A-4-9-Billion-Dollar-Decrease-in-Health-Care-Expenditure>
7. Zhu SH, Lee M, Zhuang YL, Gamst A, Wolfson T. Interventions to increase smoking cessation at the population level: how much progress has been made in the last two decades? *Tob Control*. 2012;21(2):110-8. Available from: <https://tobaccocontrol.bmj.com/content/21/2/110.long>
8. Rychetnik L, Hawe P, Waters E, Barratt A, Frommer M. A glossary for evidence based public health. *J Epidemiol Community Health*. 2004;58(7):538-45. Available from: <https://jech.bmj.com/content/58/7/538.long>
9. Khangura S, Konnyu K, Cushman R, Grimshaw J, Moher D. Evidence summaries: the evolution of a rapid review approach. *Syst Rev*. 2012;1:10. Available from: <https://systematicreviewsjournal.biomedcentral.com/articles/10.1186/2046-4053-1-10>
10. Ali A, Kaplan CM, Derefinko KJ, Klesges RC. Smoking cessation for smokers not ready to quit: meta-analysis and cost-effectiveness analysis. *Am J Prev Med*. 2018;55(2):253-62. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6055474/>
11. Cheung KL, Wijnen BFM, Hilgsmann M, Coyle K, Coyle D, Pokhrel S, et al. Is it cost-effective to provide internet-based interventions to complement the current provision of smoking cessation services in the Netherlands? An analysis based on the EQUIPTMOD. *Addiction*. 2018;113 Suppl 1:87-95. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/add.14069>

12. Ekpu VU, Brown AK. The economic impact of smoking and of reducing smoking prevalence: review of evidence. *Tob Use Insights*. 2015;8:1-35. Available from: <https://journals.sagepub.com/doi/full/10.4137/TUI.S15628>
13. Kirsch F. A systematic review of quality and cost-effectiveness derived from Markov models evaluating smoking cessation interventions in patients with chronic obstructive pulmonary disease. *Expert Rev Pharmacoecon Outcomes Res*. 2015;15(2):301-16.
14. Peletidi A, Nabhani-Gebara S, Kayyali R. Smoking cessation support services at community pharmacies in the UK: a systematic review. *Hellenic J Cardiol*. 2016;57(1):7-15.
15. van den Brand FA, Nagelhout GE, Reda AA, Winkens B, Evers SMAA, Kotz D, et al. Healthcare financing systems for increasing the use of tobacco dependence treatment. *Cochrane Database Syst Rev*. 2017;9:CD004305.
16. White P, Skirrow H, George A, Memon A. A systematic review of economic evaluations of local authority commissioned preventative public health interventions in overweight and obesity, physical inactivity, alcohol and illicit drugs use and smoking cessation in the United Kingdom. *J Public Health*. 2018; 40(4):e521-30. Available from: <https://academic.oup.com/jpubhealth/article/40/4/e521/4865967>
17. Health Evidence. Quality assessment tool - review articles [Internet]. Hamilton, ON: Health Evidence; 2016 [cited 2019 Dec 4]. Available from: http://www.healthevidence.org/documents/our-appraisal-tools/QATool&Dictionary_01Jun16.pdf
18. Evers S, Goossens M, de Vet H, van Tulder M, Ament A. Criteria list for assessment of methodological quality of economic evaluations: Consensus on Health Economic Criteria. *Int J Technol Assess Health Care*. 2005;21(2):240-5.
19. Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, et al. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. *Int J Technol Assess Health Care*. 2013;29(2):117-22.
20. Claxton K, Martin S, Soares M, Rice N, Spackman E, Hinde S, et al. Methods for the estimation of the National Institute for Health and Care Excellence cost-effectiveness threshold. *Health Technol Assess*. 2015;19(14):1,503, v-vi. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK274312/>.
21. Ryen L, Svensson M. The willingness to pay for a quality adjusted life year: a review of the empirical literature. *Health Econ*. 2015;24(10):1289-301.
22. Doll R, Peto R, Boreham J, Sutherland I. Mortality in relation to smoking: 50 years' observations on male British doctors. *BMJ*. 2004;328(7455):1519. Available from: <https://www.bmj.com/content/328/7455/1519>
23. Mahmud A, Feely J. Effect of smoking on arterial stiffness and pulse pressure amplification. *Hypertension*. 2003;41(1):183-7. Available from: <https://www.ahajournals.org/doi/full/10.1161/01.hyp.0000047464.66901.60>

24. U.S. Department of Health and Human Services. The health benefits of smoking cessation: a report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services; 1990. Available from: <https://profiles.nlm.nih.gov/spotlight/nn/catalog/nlm:nlmuid-101584932X37-doc>
25. U.S. Department of Health and Human Services. The health consequences of smoking: a report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services; 2004. Available from: https://www.ncbi.nlm.nih.gov/books/NBK44695/pdf/Bookshelf_NBK44695.pdf
26. U.S. Department of Health and Human Services. The health consequences of smoking: nicotine addiction: a report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services; 1988. Available from: <https://profiles.nlm.nih.gov/spotlight/nn/catalog/nlm:nlmuid-101584932X423-doc>

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