Title:	Impact Assessment (IA)
Antimicrobial Resistance Strategy	**Date:** 21/08/2013
IA No: 3106	**Stage:** Final
Lead department or agency:	**Source of intervention:** Domestic
Department of Health	**Type of measure:** Other
Other departments or agencies:	**Contact for enquiries**: Sally Wellsteed
DEFRA	

Summary: Intervention and Options

RPC: RPC Opinion Status

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANCB on 2009 prices)	**In scope of One-In, One-Out?**	**Measure qualifies as**
£-11.5m	£-7.8m	£-0.9m	No	NA

What is the problem under consideration? Why is government intervention necessary?

The use of antimicrobials has a wider cost to society that is not faced by the individual who receives them or practitioner who prescribes them. This cost is due to resistance to antimicrobials, which is predicted to rise over time without intervention. This may lead to a situation where multi-drug-resistant microbes increase, so that regular surgery & other medical procedures (e.g. chemotherapy) carry a substantial risk of death. Few new drugs are coming onto the market that would be able to treat these bacteria. As a result, antibiotics are likely to be overused and intervention is necessary to ensure that these external costs (of increased resistance) are taken into account by practitioners and individuals. No regulatory action is proposed.

What are the policy objectives and the intended effects?

The objective of this strategy is to reduce the use of antibiotics where it is safe and appropriate to do so, in order to reduce current and future prevalence of antimicrobial resistance. This will be achieved by:
(a) Improving infection prevention and control to reduce the need for antibiotics in the first place;
(b) Promoting antibiotic stewardship, in order to preserve currently effective therapies, focussing on the appropriate use of these drugs (right drug, dose, duration every time);
(c) Improving knowledge on resistance mechanisms;
(d) Facilitating the development of new drugs, vaccines and diagnostics

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

(0) Do nothing. This would neither address the rapidly increasing public health need nor enable us to comply with the 2012 EU Council Conclusions;
(1) Produce and implement a UK cross-governmental strategy to tackle AMR and meet our EU commitments. This strategy contains a number of different policies, which are detailed below. All action would be purely voluntary, with effects expected through increased awareness.
Options to address the pipeline of new antibiotics are being taken forward elsewhere; this IA focuses on policies to address the demand and use of antibiotics. No regulatory action is proposed. The preferred option is option (1), as it will reduce the likelihood of a scenario where microbes develop multi-drug resistance. This benefit cannot be accurately quantified, but may be in the region of billions of pounds per year. These substantially outweigh the quantified costs, which are in the region of a few millions of pounds

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 12/2018

Does implementation go beyond minimum EU requirements?			N/A		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro** No	**< 20** No	**Small** No	**Medium** No	**Large** No
What is the CO2 equivalent change in greenhouse gas emissions? (Million tonnes CO2 equivalent)			**Traded:** N/A	**Non-traded:** N/A	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible SELECT SIGNATORY: ..... Date: .....

Summary: Analysis & Evidence

Policy Option 1

Description: Produce and implement a strategy to tackle antimicrobial resistance

FULL ECONOMIC ASSESSMENT

Price Base Year 2012	PV Base Year 2012	Time Period Years 10	Net Benefit (Present Value (PV)) (£m) Low: Optional	High: Optional	Best Estimate: -11.5

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional	1	Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	16.5		3.1	42.8

Description and scale of key monetised costs by 'main affected groups'

All costs are incurred voluntarily, as there are no requirements or regulations. NHS, non-NHS hospitals and GP surgeries incur time costs from introducing one-off and annual audits of antimicrobial usage, from improving their documentation of antimicrobials, as well as from reading and digesting the strategy. There are further small costs to NHS & non-NHS hospitals in monitoring bacteraemias and susceptibility. Farmers incur costs from reviewing and updating the antimicrobial stewardship plans.

Other key non-monetised costs by 'main affected groups'

Plans are being developed to support delivery of the Strategy in the NHS and so it is not possible, at present, to reflect all the likely costs associated with implementation of the strategy in the NHS.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional	N/A	Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	0		3.6	31.3

Description and scale of key monetised benefits by 'main affected groups'

Only a small portion of the overall benefits can be monetised. Improved antimicrobial prescribing may reduce the length of time that patients with sepsis need to be in hospital. This will yield ongoing cost savings to hospitals.

Other key non-monetised benefits by 'main affected groups'

If multi-drug resistance grows, routine surgery would carry a much higher risk of death. The benefit of postponing and reducing the likelihood of such a scenario is substantial but difficult to quantify. Some calculations suggest that this benefit is in the region of billions of pounds each year. However, this has not been included in the monetised benefits, due to the high uncertainty involved. Nevertheless, it is one or two orders of magnitude greater than the costs involved.

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5%

The analyses assume that there will not be a substantial change in the number of antimicrobials prescribed. This is a reasonable assumption, as the main intention is to ensure that the most appropriate antimicrobials are used, rather then reducing the number. If the number is reduced, this carries the risk that patients who do require an antimicrobial may not receive it, damaging their health. However, this is not expected to occur, as the strategy does not impose regulations on organisations

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 0	**Benefits:** 0	**Net:** 0	No	NA

Evidence Base (for summary sheets)

Please note: no regulatory action is proposed in the strategy and associated Impact Assessment: any benefits and costs will be incurred voluntarily.

Introduction

1. The rapid spread of multi-resistant bacteria and the lack of new antibiotics to treat infections caused by these organisms poses a rapidly increasing threat to public and animal health and needs to be tackled if we are to contain the problem and prevent untreatable illness becoming a reality. Antimicrobials (i.e. antibiotics, antivirals and antifungals) are the cornerstone in modern medical practice for treatment and prophylaxis and the lack of new antibiotics has provided a driver for action in this area. Containing the problem and preventing the untreatable illness and premature mortality situation is a clear priority. The need for collective action to ensure antibiotics are used wisely and sparingly has never been more important than now.

2. The 2013-2018 UK AMR strategy builds on the 2000 UK Strategy and Action Plan and takes account of developments at EU and international level, including the 2011 EU Strategic Action Plan, and 2012 EU Council Conclusions. It also provides a framework for collaborative work to champion the responsible use of antibiotics, strengthen research and surveillance capability, facilitate behaviour change through more responsible prescribing and better use of antibiotics.

3. The World Health Organisation has sounded the alarm about the growing problem of AMR:

WHO: Why is antimicrobial resistance a global concern?[1]

AMR kills

Infections caused by resistant microorganisms often fail to respond to the standard treatment, resulting in prolonged illness and greater risk of death.

AMR hampers the control of infectious diseases

AMR reduces the effectiveness of treatment because patients remain infectious for longer, thus potentially spreading resistant microorganisms to others.

AMR threatens a return to the pre-antibiotic era

Many infectious diseases risk becoming uncontrollable and could derail the progress made towards reaching the targets of the health-related United Nations Millennium Development Goals set for 2015.

AMR increases the costs of health care

When infections become resistant to first-line medicines, more expensive therapies must be used. The longer duration of illness and treatment, often in hospitals, increases health-care costs and the financial burden to families and societies.

AMR jeopardizes health-care gains to society

The achievements of modern medicine are put at risk by AMR. Without effective antimicrobials for care and prevention of infections, the success of treatments such as organ transplantation, cancer chemotherapy and major surgery would be compromised.

AMR threatens health security, and damages trade and economies

The growth of global trade and travel allows resistant microorganisms to be spread rapidly to distant countries and continents.

[1] http://www.who.int/mediacentre/factsheets/fs194/en/

4. The Chief Medical Officer has emphasised the importance of tackling antimicrobial resistance:[2]

> *"Antibiotics are losing their effectiveness at a rate that is both alarming and irreversible – similar to global warming.*
>
> *"I urge patients and prescribers to think about the drugs they are requesting and dispensing.*
>
> *"Bacteria are adapting and finding ways to survive the effects of antibiotics, ultimately becoming resistant so they no longer work. And the more you use an antibiotic, the more bacteria become resistant to it."*

5. The scale of the threat of antimicrobial resistance (AMR) and the case for action was set out in the Chief Medical Officer (CMO) for England's Annual Report 2013 which made three key recommendations on AMR (https://www.gov.uk/government/publications/chief-medical-officer-annual-report-volume-20). This strategy sets out actions to address AMR in those three areas.

Problem under consideration & rationale for intervention

6. The use of antimicrobials, especially antibiotics, has a wider cost to society that is not faced by the individual who receives them or practitioner who prescribes them. This cost is due to increased resistance, which may lead to a situation where multi-drug-resistant bacteria increase, so that regular surgery and other medical procedures (such as chemotherapy) carry a substantial risk of death. Few new drugs are coming onto the market that would be able to treat infections due to these bacteria. As a result, antibiotics are likely to be overused and intervention is necessary to ensure that these external costs (of increased resistance) are taken into account by practitioners and individuals.

7. The UK has had a programme of work to tackle antimicrobial resistance (AMR) since 2000 but due to the increasing spread of multi-resistant bacteria there is an urgent need to strengthen our activities as there are very limited treatment options for people with these infections. We have to rely on the few drugs that are still active against multi-resistant bacteria and this increases the selective pressure for resistance. AMR is a public health priority because while current costs are relatively small and mainly associated with longer hospital stays and expenditure, they will be very large if hard to treat infections become prevalent.

8. While the strategy covers all antimicrobials there is a particular focus on antibiotics as these are a cornerstone of modern medicine, for example administering antibiotics before surgery reduces the risk of infections developing. Unless concerted action is taken now we could face a future where routine medical procedures will become much riskier and lead to an increase in morbidity and mortality from infections.

9. Previously our response to the development of resistance was simply to move to new antibiotics but it is no longer possible to rely only on this – there is a dearth of new drugs especially for Gram negative organisms such as *E. coli*. The spread of multi-resistant bacteria is an issue for patients as there are very limited treatment options for such infections and are associated with greater morbidity and mortality.

10. There is no simple answer to tackling AMR and, as AMR is driven by the use of antibiotics, action is required on a number of fronts to protect existing therapies and help develop new drugs and diagnostics. As indicated above, a significant programme is already underway and this strategy seeks to strengthen this and promote faster action.

[2] http://www.dh.gov.uk/health/2012/11/eaad-cmo/

Policy Objective

11. The objective of this strategy is to reduce the use of antibiotics where it is safe and appropriate to do so, in order to reduce current and future prevalence of antimicrobial resistance. This is intended to be achieved by:

    - Improving infection prevention and control to reduce the need for antibiotics in the first place
    - Promoting antibiotic stewardship, in order to preserve currently effective therapies, focussing on the appropriate use of these drugs (right drug, dose, duration every time)
    - Improving knowledge on resistance mechanisms
    - Facilitating the development of new drugs, vaccines and diagnostics

Description of options considered

12. Two main options are under consideration; although the second option in reality represents a package of measures, which are each effective in isolation, yet mutually reinforcing as a package:

    (0) Do nothing

    (1) Produce and implement a strategy to tackle AMR

Option 0: Do nothing

13. Under this option, no further action would be taken. However, there are a number of existing policies that tackle different aspects of AMR, which would continue in the absence of the strategy.

Option 1: Produce and implement a strategy to tackle AMR

14. The strategy brings together the main components of AMR work in the UK and thus will help improve co-ordination and information sharing between different stakeholders so uptake of existing initiatives occurs more quickly. To have maximum impact a wide range of intervention measures are needed which will safeguard human and animal health. This will be achieved by focussing on the following seven key areas:

    (i) Improving infection prevention and control practices in human and animal health.

    (ii) Optimising prescribing practice.

    (iii) Improved education, training and public engagement.

    (iv) Developing new drugs, treatments and diagnostics.

    (v) Better access to and use of surveillance.

    (vi) Better identification and prioritisation of AMR research needs.

    (vii) Strengthened international collaboration.

15. A wide programme of work to tackle antimicrobial resistance has been underway across the UK in human and animal health sectors for a number of years. While much has been achieved so far and provides a good basis to deliver further gains there are also a number of new areas which require attention. This integrated, UK strategy seeks to bring this work together in a co-ordinated manner and accelerate progress in addressing the challenges we face now and in the future.

16. Key priorities for the future will be:

- Slowing down the development of antimicrobial resistance;
- Maintaining the efficacy of existing antimicrobials (e.g. embedding antimicrobial stewardship programmes, stricter infection prevention and control and responsible use);
- Developing new antimicrobials and alternative treatments (especially medicines to tackle multi-drug resistant gram negative bacteria);
- Investigating the link between antimicrobial use in animals / food and the spread of resistance in humans;
- Minimising antibiotics entering the environment;
- Strengthening the information on environmental reservoirs of resistance to provide early warning of potential resistance mechanisms and enable us to take proactive measures to address the issue; and
- Co-ordination of a multi-sectoral approach to AMR which invokes the practitioners and users of antimicrobials in each sector

17. Key actions will include:

- Change those attitudes and behaviours that have hampered progress in achieving responsible and appropriate use of antibiotics, optimise antimicrobial prescribing and administration practices.
- Promote effective stewardship to help arrest AMR while delivering improvements in outcomes and quality of life of those undergoing treatment.
- Encourage an environment which fosters innovation and addresses some of the hurdles which have hindered antibiotic development in recent years.
- Put in place measures to improve data on antimicrobial use, appropriate prescribing and administration of antimicrobials in all sectors, including limiting the veterinary use of antibiotics that are critically important for human medicine or where there is a risk of cross resistance.
- Improve diagnosis of infections, treatment by promoting more consistent and comprehensive recording of clinical information.
- Address risks from domestic selective pressure and imported infections, continue to work with international colleagues to share information on emerging issues and identify early warning or alert systems to trigger the instigation of appropriate containment measures to minimise the risk of transfer of increasing antimicrobial resistance and development of multi-drug resistance.

18. This multi-pronged approach is expected to deliver benefits in terms of assuring human health, protecting existing medical practice and ensuring good animal health and welfare for the future. To effectively control the use of antibiotics, without significant detriment of human or animal health, a wide range of activities are proposed. These include measures to preserve existing therapies, slow down the development and spread of resistance (through improving infection prevention and control and reinforcing the need for improved and optimised prescribing practice) as well as the development of new antibacterial agents and diagnostic tools in all sectors.

19. This new UK five year AMR strategy has a holistic integrated approach and builds on the outputs from the 2000 UK AMR strategy,[3] and other work to improve public and professional knowledge, promote better prescribing practice, and seeks to encourage greater collaborative action to address innovative research to facilitate development of diagnostics and new therapeutics.

20. The release of the strategy itself is expected to raise awareness of the need for action amongst the public and professionals. The strategy will also introduce outcome measures to enable

[3] http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4078448.pdf

monitoring of progress in tackling AMR, raise societal awareness of the issue and thus accelerate ongoing work. The strategy will also ensure we meet EU commitments for a national strategy and action plan. These specific actions are described in more detail below, and include:

a) Monitor current levels of resistance in specific microbe-drug combinations

b) Improved uptake of Start Smart Then Focus in secondary care

c) Improved usage of Target web-based tool by GPs

d) Improved antimicrobial stewardship in the farmed animals sector.

Monetised and non-monetised costs and benefits of option 0

21. Without intervention, a number of policies aimed at tackling antimicrobial resistance would continue. These include:

- Support for European Antibiotic Awareness Day to raise awareness of the public and professionals
- Development of new tools such as Target for GPs to support improvements in practice
- Recently introduced restrictions on the use of fluoroquinolones and 3rd & 4th generation cephalosporins

22. These would persist but without the overarching coherence and emphasis that would occur with the introduction of a strategy. The following sections outline the effects of introducing a strategy: these are additional costs and benefits, incremental over and above option 0.

Monetised and non-monetised costs and benefits of option 1

23. This section describes the incremental costs and benefits of introducing the strategy across the UK, over and above actions that are already ongoing. These costs and some of the benefits are specific to each of the key areas of action. However, they all contribute to an improvement in antibiotic stewardship, which will reduce the prevalence of antimicrobial resistance and any increase over time. This is the main benefit of introducing the strategy, but it is difficult to quantify or monetise, as the effects are only likely to be felt in the longer run.

24. The strategy brings together a number of existing, new and planned actions. Major new effects as a result of the publication of the strategy include new activities, increasing the effectiveness of existing measures, and embedding interventions which appear to be effective. Existing initiatives that will not be substantially affected, along with future planned initiatives are not included here.

25. The following actions have been identified as the focus of these calculations (although there will be further effects):

a) Monitor current levels of resistance in specific microbe-drug combinations

b) Improved uptake of Start Smart Then Focus in secondary care

c) Improved usage of Target web-based tool by GPs

d) Improved antimicrobial stewardship in the farmed animals sector.

Number of antibiotics

26. The main estimates of the impact of the strategy assume that there will be no substantial change in the number of antibiotics used (and antimicrobials more widely), with the exception of the farmed animal sector, where there is an ambition to reduce usage of critically important antibiotics (CIAs). The main impact in the other sectors comes through a change in the type and

appropriateness of antibiotics used, as well as changes to antimicrobial stewardship programmes.

Benefits of strategy overall

27. As described above, the main aim and intended benefit of the strategy is to postpone and reduce the likelihood of a scenario where microbes develop resistance. The short run benefits of reducing resistance are small, as many infections that are resistant to one antimicrobial agent may be sensitive to another. While the other agent might be more expensive, this cost is relatively small.

28. However, more substantial problems arise when infections become resistant to multiple drugs. In such a scenario, routine surgery would bring with it a high likelihood of infection that, while currently treatable with existing antimicrobials, would be untreatable and potentially life threatening. The costs of this are very difficult to quantify, but are substantial. Work has been commissioned by the Department of Health investigating this, and is published in the *British Medical Journal*: R Smith & J Coast "The true cost of antimicrobial resistance" (http://www.bmj.com/content/346/bmj.f1493). The following paragraphs present some indicative quantification, but should be treated with extreme caution, as they are speculative. Nevertheless they demonstrate the scale of the potential problem.

29. For example, total hip replacement currently carries with it low risks of infection and negligible death rates, practically 0%. The above paper by Smith & Coast estimates that "removal of antibiotics would increase postoperative infection by 1-50% and deaths by 0-30%." With around 73,000 total hip replacements per year (source: Hospital Episode Statistics), this could lead to tens of thousands of additional deaths. The average age of these individuals is 69. Based on ONS projections, a 69-year-old has a quality-adjusted life expectancy of around 12 QALYs (quality-adjusted life year). This suggests a loss in the region of hundreds of thousands of QALYs each year. This would translate into a cost in the tens of billions of pounds each year (when a QALY is valued at £60,000, a figure compatible with values for life-saving used elsewhere across government). As Smith & Coast note: "Of course, at such [high mortality] rates it is likely that the rates of hip replacement would fall, which would increase the burden of morbidity from hip pain." The QALY gain from hip replacement has been estimated as nearly 3 QALYs per patient (Appleby J, Poteliakhoff E, Shah K, Devlin N, Using patient-reported outcome measures to estimate cost-effectiveness of hip replacements in English hospitals, *Journal of the Royal Society of Medicine*; 2013: 106(8): 323–331.) If the 73,000 hip patients opted to live with their pain instead of undergoing surgery (that carried an increased mortality risk of up to 30%), they would lose nearly 3 QALYs each. Again, this suggests a loss in the region of hundreds of thousands of QALYs each year. This would be valued in the tens of billions of pounds each year.

30. As mentioned above, this analysis is speculative. However, it shows the potential costs that may arise if extensive resistance occurs to antimicrobials in the field of hip surgery. Indeed, there would be further substantial costs in different fields of surgery, as well as wider medical procedures (such as chemotherapy). For example, around forty years ago, people with cystic fibrosis generally died within their first decade of life. The median life expectancy is now over 50 years. As set out by Plummer & Wildman (2011)[4], "One of the major reasons for this increase in survival is the mounting use of antibiotics to treat chest exacerbations caused by bacterial infections." As a result, if these antibiotics were no longer able to treat such infections, the life expectancy of cystic fibrosis patients would be likely to fall substantially.

31. Appropriate antimicrobial stewardship reduces the likelihood of this scenario and postpones its arrival, generating further time in which new antimicrobials can be created. However, even merely postponing such an event by a few years yields substantial benefits. Due to the effects of discounting, postponing a scenario with a health detriment by around ten years reduces the present value of that cost by over 10% (when using a discount rate of 1.5% per year, as

[4] Plummer A, Wildman M. Duration of intravenous antibiotic therapy in people with cystic fibrosis. Cochrane Database of Systematic Reviews 2011, Issue 1. Art. No.: CD006682. DOI: 10.1002/14651858.CD006682.pub3.

recommended for health effects). This implies that merely postponing the scenario described above would lead to a benefit of over a billion pounds each year (with further benefits in different fields of surgery).

32. Each of the areas described below contributes to these benefits (with further quantifiable benefits identified in one area. The following quantifiable costs should therefore be understood in the context of postponing and reducing the likelihood of a scenario that would bring with it costs (in terms of lives lost) in the region of billions of pounds each year.

Effects of publication of strategy

Benefits

33. The publication of the strategy itself is expected to have a positive impact on antimicrobial stewardship and therefore a reduction in antimicrobial resistance. This is through generally raising awareness of existing programmes and reminding individuals involved of general best practice. This is the main benefit of introducing the strategy, but it is difficult to quantify or monetise.

Costs

34. Any costs incurred, will be incurred voluntarily. In order for the publication of the strategy to have this impact, there will be time costs for relevant individuals to read and reflect on the strategy, and to introduce any subsequent changes in practice. This will cover a number of sectors: primary care and secondary care clinicians, pharmacists, farmers, veterinarians and academic researchers. While the costs are low for each individual and organisation, the number of organisations likely to be affected is large. As a result, these costs may be in the region of £13m in year one (with no costs in future years), detailed in Annex 1. While this figure captures the main groups, there will be other interested parties who read the strategy.

35. The costs of introducing subsequent changes to practice will depend on the size of the organisation and the organisation's current practice on antimicrobial stewardship. For those organisations where antimicrobial stewardship is not optimal, there may be greater costs. It would be inappropriate (and potentially misleading) to give a monetary estimate of the costs, but note the fact these may occur. As part of the technical engagement exercise we sought feedback from a wide range of stakeholders, including the NHS, on these costs and did not receive any additional data. NHS England are currently developing plans to support delivery of the AMR Strategy and so it is not possible, at present, to reflect all the likely costs associated with implementation of the strategy in the NHS. It is very likely however that any costs associated with monitoring and improving antimicrobial usage and tracking resistance will result in wider benefits that outweigh the associated costs. While this imposes no requirements or regulation on the private sector, it is expected that there will be a time cost to the private sector in reading and digesting the strategy. This is expected to be in the region of £4m in year one (with no costs in future years).

(a) Monitor current levels of resistance in specific microbe-drug combinations

36. Under this action, laboratories will report susceptibility data on a specified set of bacteria and drug combinations (for example, the percentage of people with E. coli and treated with gentamicin who are not susceptible to gentamicin – see annex B for the full list). These particular combinations have been chosen as they represent areas that are difficult to treat. A number of laboratories already provide this information, but it is not comprehensive. While this option will not make such surveillance mandatory, such a request from the PHE will encourage all laboratories to report this data.

Benefits

37. Increased monitoring is likely to lead to an improved understanding of the geographical spread and trends over time in specific areas of resistance. It may also enable more rapid identification of any outbreak of resistant bacteria, leading to a swifter response. However, such benefits are not possible to quantify and will be dependent on how resistance changes and develops over time.

Costs

38. Any costs incurred, will be incurred voluntarily. Laboratories of acute trusts (predominantly in the NHS) will need to provide data on clinically significant bacteraemia as well as susceptibility data to the PHE, requiring a change in lab's data extraction processes. The cost of this would be around £8,000 in year one only across all relevant laboratories (around £400 of which would fall on the private sector). In addition, testing of isolates of gonorrhoea will need to be changed, requiring time in both NHS organisations and at the PHE. The cost of this is expected to be approximately £157,000 per year. The total cost for this action would be around £160,000 per year. Of this, the cost to the private sector would only be in the region of a few hundred pounds per year. It should be noted that there are no regulatory requirements, so private organisations would not be required to comply with this, although it is expected that they would choose to do so. See annex A for more details on how these figures are derived.

(b) Improved uptake of Start Smart Then Focus in secondary care

39. The Start Smart Then Focus (SSTF) guidance in secondary care was launched in November 2011. It provides an outline of evidence-based antimicrobial stewardship in secondary healthcare settings.

Start Smart is:

- Do not start antibiotics in the absence of clinical evidence of bacterial infection
- If there is evidence/suspicion of bacterial infection, use local guidelines to initiate prompt effective antibiotic treatment
- Document on drug chart and in medical notes: clinical indication, duration or review date, route and dose
- Obtain cultures first
- Prescribe single dose antibiotics for surgical prophylaxis; where antibiotics have been shown to be effective

Then Focus is:

- Review the clinical diagnosis and the continuing need for antibiotics by 48 hours and make a clear plan of action - the "Antimicrobial Prescribing Decision"
- The five Antimicrobial Prescribing Decision options are: Stop, Switch IV to Oral, Change, Continue and Outpatient Parenteral Antibiotic Therapy (OPAT).
- It is essential that the review and subsequent decision is clearly documented in the medical notes

40. Initial intelligence suggests some initial returns from the policy. Introduction of the strategy may raise its profile and increase implementation across NHS acute hospitals, with associated costs and benefits.

Benefits

41. Improved implementation of SSTF is likely to lead to improved quality of prescribing in NHS acute trusts. For example, a joint ESCMID-ISC survey on Antimicrobial Stewardship found that, among those hospitals that had conducted a formal review of their antimicrobial stewardship programme, over 75% of hospitals had seen a reduction in inappropriate prescribing following SSTF. There

may be a slight reduction in the quantity prescribed (as patients are taken off unnecessary antibiotics sooner than before), leading to a cost saving for hospitals. However, this is likely to be small, as the main benefit comes from more appropriate prescribing.

42. The effect of improved quality of prescribing will be twofold – affecting both the short run and the long run. In the long run, improved quality of antibiotic prescribing will lead to better tailored antibiotics, following the Start Smart Then Focus description: “Right Drug, Right Dose, Right Time, Right Duration, Every Patient”. This is likely to lead to reduced antimicrobial resistance over time, as inappropriate antimicrobials are reduced.

43. There is also likely to be a more immediate effect of this policy, but one which would be ongoing. Improved quality of prescribing would reduce the amount of time patients’ suffer infection and prevent the onset of other infections, thereby improving their quality of life and reducing their length of stay in hospital (freeing up resources to be used for other patients). It is difficult to quantify this benefit, as it will have an impact on a wide range of patients, who will have varying conditions. This is consistent with the evidence from a joint ESCMID-ISC survey on Antimicrobial Stewardship, which found that over 10% of centres that had formally assessed their AMS service, 10% had shown a reduced length of stay following the introduction of SSTF.

44. One area where improved quality may have a measurable impact is in the treatment of sepsis. Patients with sepsis will spend extended periods of time in critical care beds, with organ support required. Assuming that around 5% of these patients benefit from reduced lengths of stay, the total benefit across the UK may total £3.6m per year.

45. There would be further health benefits from improving treatment of septicaemia, as well as the longer term benefits of reducing antimicrobial resistance. Tentative evidence from the UK CPA survey suggests that nearly a quarter of hospitals have already demonstrated a reduction in antimicrobial resistance in their settings. The effects of this are likely to be felt much more widely, as resistant strains of infections are therefore less likely to be carried in the general population. However, these benefits cannot be quantified.

Costs

46. Any costs incurred, will be incurred voluntarily. Data from the joint ESCMID-ISC survey suggests that over 90% of hospitals have performed at least a short information review based on the SSTF guidance. However, only around 45% had conducted a formal written review. In this latter set of hospitals, only a short review may be required, while a longer review may be needed in the remaining hospitals. Further evidence from the survey suggests there remain variations in practice, for example around the existence of antimicrobial stewardship ward rounds. These reviews may cost approximately £250,000 to NHS organisations in year one only, with a further £13,000 to private organisations in year one only. The publication of the strategy may also encourage a small proportion of hospitals to undertake annual audits and share these results with the relevant hospital staff. If this occurs in around 10% of hospitals, there may be ongoing costs of around £330,000 to NHS organisations per year, with a further £17,000 to private organisations per year. See annex A for more details.

47. There will be increased ongoing time costs for consultants due to this rise in documentation. Evidence from a joint ESCMID-ISC survey on Antimicrobial Stewardship suggest that less than 80% of those surveyed in hospitals fully documented the indication and duration of prescribed drugs. Therefore, this IA assumes that the policy may increase documentation in around 10% of all cases, with an ongoing cost of £2.0m per year for NHS hospitals. Among private hospitals, the figure is much lower, at approximately £0.1m per year. Annex A has more details. It should be noted that this is not a regulatory requirement, so private hospitals would not be required to comply with this, although it is expected that they would choose to do so. The reviews and audits undertaken by hospitals will likely lead to changes in practice for each hospital, depending on

their current use of the SSTF guidance. There may be some additional costs but it is not possible to indicate the scale of these costs in this IA.

(c) Improved usage of Target web-based tool by GPs

48. A new web based toolkit (Target) to support GP prescribing has been developed by the Royal College of General Practitioners (RCGP) and the Health Protection Agency (HPA). It is expected that around 50% of GPs will consult the website and use some of the materials in their practice. Publicising this tool in the strategy is likely to increase awareness and take-up.

Benefits

49. Improved uptake of the Target tool is likely to lead to improved quality of prescribing in primary care settings. There may be a slight reduction in the quantity prescribed (as patients are taken off unnecessary antibiotics sooner than before, or are not prescribed them originally), leading to a cost saving for GP surgeries. However, this is likely to be small, as the main benefit comes from more appropriate prescribing.

50. The effect of improved quality of prescribing will be primarily in the long run, in the form of improved quality of antibiotic prescribing. This follows the Start Smart Then Focus description: “Right Drug, Right Dose, Right Time, Right Duration, Every Patient”. This is likely to lead to reduced antimicrobial resistance over time, as inappropriate antimicrobials are reduced.

Costs

51. Any costs incurred, will be incurred voluntarily. The Impact Assessment assumes that publication of the strategy will increase uptake of Target by around 10% among GPs and GP practices. This will lead to a one-off time cost in acquainting themselves with the Target tool of around £360,000 in year one only. However, there will be ongoing costs as GPs review their antimicrobial prescribing annually, requiring some administrative support. These findings will need to be communicated to practice staff. In all, the ongoing cost is expected to be around £440,000 per year. There are no costs on the private sector. For more information, see annex A.

(d) Improved antimicrobial stewardship in farmed animals sector

52. Following the publication of the strategy, it is expected that farmers will review their antimicrobial stewardship programmes. This is in addition to the time spent reading and reviewing the strategy itself (as presented above). These reviews may cover their Farm Health Plans (or result in their introduction in some farms), and biosecurity measures. The effect of improved antimicrobial stewardship will be felt in the long run, in the form of improved quality of antibiotic usage. This is likely to lead to reduced antimicrobial resistance over time, as inappropriate antimicrobials are reduced. The more immediate and quantifiable costs and benefits are presented below.

Costs

53. Any costs incurred, will be incurred voluntarily. While it is not known how many farmers would undertake such reviews, this Impact Assessment assumes that around 20% of farmers will review their practices. While the costs are small per farm, there are over 200,000 farms in the UK, leading to a total cost in year one of £3.0m. It should be noted that this is not a regulatory requirement, so farmers would not be required to comply with this, although it is expected that they would choose to do so. See annex A for more details.

Benefits

54. It is expected that the annual sales of critically important antimicrobials (CIAs) will reduce as a result of this. Existing data suggests that the CIA market in the farmed animals sector is a small proportion of the overall market in that sector. For example, fluoroquinolones and 3rd and 4th

generation cephalosporins accounted for only 0.8% of the total weight of antibiotics sold in 2010 (447 tonnes). Macrolides account for another 7.8% of total antibiotics. While this shows the scale by tonnage, there are currently no robust and comprehensive data on the financial scale of this market

55. In making this reduction, farmers may either switch to other antibiotics, or may not. In the former case, costs for farmers may decrease (if the switch is to cheaper antibiotics, for example from branded to generic ones). There will be an associated loss to pharmaceutical companies in terms of the profits if the switch is from high-profit antibiotics to low-profit ones. The loss in profits may equal the gain to farmers, leading to a neutral outcome in aggregate. In the latter case, farmers will make a saving. Pharmaceutical companies will see a fall in profits. However, this will be smaller than the benefit to farmers (as profits must be less than the price of the antibiotic). This would result in a net gain to the economy in aggregate.

Overall impact of strategy (option 1)

Costs

56. Any costs incurred, will be incurred voluntarily. The following table summarises the incremental costs involved in implementing the elements of the strategy described above, split by public and private impact. The total cost is expected to be in the region of £3m per year, with a further one-off cost in year one of £16m. Of this, the cost to the private sector is around £0.1m per year, with a one-off cost in year one of £7m.

57. As mentioned before, the strategy brings together a number of existing, new and planned initiatives. Those presented here are the major new effects as a result of the publication of the strategy. Existing initiative that will not be substantially affected, along with future planned initiatives are not included here. The 'Total' column shows the present value of these costs, as measured over ten years, using the Government's standard discount rate of 3.5% per year. It should be noted that none of the elements of the strategy are regulatory requirements, so private organisations would not be required to comply with this, although it is expected that they would choose to do so.

Summary of Costs (£m)

	NHS			Private			Overall		
	Year one	**Ongoing**	**Total**	**Year one**	**Ongoing**	**Total**	**Year one**	**Ongoing**	**Total**
Publication of strategy	9.04	-	9.04	3.78	-	3.78	12.82	-	12.82
(a) Monitoring of resistance	-	0.16	1.41	-	0.0004	0.003	-	0.16	1.42
(b) Uptake of SSTF in secondary care	0.25	2.34	20.37	0.01	0.12	1.03	0.26	2.46	21.40
(c) Usage of Target in primary care	0.36	0.44	4.13	-	-	-	0.36	0.44	4.13
(d) Improved farming sector stewardship	-	-	-	3.01	-	3.01	3.01	-	3.01
Total costs	**9.65**	**2.94**	**34.96**	**6.80**	**0.12**	**7.82**	**16.45**	**3.06**	**42.79**

* Note: figures may not sum due to rounding

Benefits

58. As described in the sections above, the majority of the benefits of the strategy cannot be quantified. The indicative scenario suggests that the benefits are likely to be in the regions of billions of pounds each year. However, it is difficult to be precise, given the high amount of uncertainty involved. There are likely to be further benefits that can be realised in the short term that may be in the region of £3.6m per year (or £31m when discounted over ten years), through the improved treatment of sepsis.

Net Benefit

59. Based on the quantified benefits and costs, there will be a net ongoing benefit of £0.6m per year. However, there will be a net one-off cost in year one of £16m. The overall net effect when discounted over ten years is a net cost of £11m. However, these show only the quantified effects over 10 years. As described above, there are substantial benefits from avoiding a scenario of multi-drug resistant microbes, which may be in the region of billions. These have not been included in the quantified benefits due to their speculative nature. Nevertheless, this is the main aim and expected benefit of the strategy.

60. As a result, while the 10-year quantified net benefit is negative, the long-run expected total net benefit (including quantified and unquantified costs and benefits) is substantially positive, with the benefits exceeding the costs by at least one (or even two) orders of magnitude. Annex A discusses sensitivity analyses. However, given the small nature of the costs (all of which are non-regulatory), even large changes in the assumptions do not change the overall conclusion.

Risks and alternative scenarios

61. The above analysis has assumed that the quantity of antibiotics prescribed and used (and antimicrobials more widely) will not change substantially (with the exception of the farmed animals sector). However, there may be a small decrease in the number of antibiotics used. If clinicians use fewer antibiotics, then their costs will decrease. Matching this, there would also be a reduction in revenue for pharmaceutical companies, alongside a reduction in production costs. The net effect for pharmaceutical companies is the reduction in profits from these antibiotic sales.

62. If the number of antibiotics used decreases, this should not lead to an increase in bacterial infections, as long as each reduction is appropriate to the specific case. However, if there is an excessive reduction in use, bacterial infections may rise. The likelihood of this is low, and mitigated by the fact that the strategy does not place any requirements on farmers, clinicians and veterinarians to reduce antibiotic use. As a result, they can continue using antibiotics where appropriate.

Rationale and evidence that justify the level of analysis used in the IA

63. This Impact Assessment has identified the main areas where the publication of the strategy is likely to affect the health system (both NHS and non-NHS). These have been quantified in some detail, demonstrating relatively low costs, in the region of a few million each year (with some further up-front costs). While it is very difficult to quantify the benefits (apart from in one specific area), this Impact Assessment has investigated a particular scenario to see the broad scale of the benefits. This suggested that the benefits may dwarf the costs by one or two orders of magnitude. Any further analysis into the potential benefits may provide more detail, but this is not likely to be robust, given the high levels of uncertainty involved.

Direct costs & benefits to business (according to OITO methodology)

64. There are no direct costs or benefits to business (according to One-In-Two-Out methodology) under either option. The proposed strategy under option 1 does not place any requirements on private sector organisations or individuals, as there are no regulations. Any costs incurred, will be incurred voluntarily. It therefore falls outside the scope of One-In-Two-Out.

Other costs & benefits to business (not included under OITO methodology)

65. The strategy is likely to lead to some costs to business that are outside the scope of OITO. These have been described in detail above. The total ongoing costs of the strategy are expected to be very low, at approximately £0.12m per year. There are also some up-front costs, particularly for farmers in reading and digesting the strategy and potentially reviewing their antimicrobial stewardship practices. These have been estimated at around £6.8m in year one. These arise because, while the costs are very low to individual farms (less than £100 per farm), there are a substantial number (over 200,000 in the UK, of which around 20% may be affected). The total discounted cost over ten years is £7.8m, with an Equivalent Annual Net Cost to Business of £0.9m.

Summary and preferred option

66. The preferred option is to introduce the strategy on antimicrobial resistance (option 1). There are immediate benefits to this, for example from reducing the amount of time that patients with sepsis need to stay in hospital. However, the most substantial benefits come from postponing and reducing the likelihood of a scenario where microbes develop multi-drug resistance. In such a scenario, routine surgery would bring with it a high likelihood of infection that, while currently treatable with existing antimicrobials, would be untreatable and potentially life threatening. The costs of this are very difficult to quantify, but may be in the region of billions of pounds per year. The strategy is likely to postpone and reduce the likelihood of this, enabling greater time for new antimicrobials to be developed. In comparison to this unquantified benefit, the quantified costs (in the region of a few millions each year) are relatively small.

67. Implementation of the strategy would be led by The Department of Health, with support from PHE and Defra and overseen and monitored on an ongoing basis against the outcome measures, by an interdepartmental High-level Steering Group (HLSG). During the first twelve months the HLSG is expected to focus on developing the detailed implementation plan and setting up the infrastructure and systems to collect surveillance data. During year two the HLSG will consider outputs from PHE's English Surveillance Programme which will inform decisions on where intervention is most needed. By year three we expect sufficient data, intelligence and information to assess whether work is on course to deliver objectives or needs adjustment, and at the end of the five-year period an evaluation report will be produced allowing assessment of the effectiveness of the implementation, as well as identifying further priorities and making recommendations.

Annex A: Detailed calculations for costs and benefits

68. This annex sets out the detailed calculations that generate the cost estimates used in the main section. Any costs incurred, will be incurred voluntarily.

Publication of strategy – costs

69. Any costs incurred, will be incurred voluntarily. In order for the publication of the strategy to have this impact, there will be time costs for relevant individuals to read and reflect on the strategy, planning their response, and introducing any subsequent changes in practice. It is assumed that each relevant person will take around three hours to do this (based on internal expert opinion). These are detailed in the table below.

Time cost of reading reflecting on strategy

Persons	Hourly cost per person (£)	Number of organis-ations	Number of persons	Persons reading full strategy per org	Persons reading executive summary per org	Cost of reading full strategy (£m)	Cost of reading executive summary (£m)	Total cost (£m)
GPs	83	10,185	42,875	1	All remainder	2.54	1.36	3.89
GP admin staff	33	10,185	-	1	-	1.01	-	1.01
GP practice nurses	33	10,185	25,387	-	All group	-	0.42	0.42
Senior pharmacists	48	-	1,354	All group	-	0.19	-	0.19
Pharmacist prescribers	26	-	1,309	All group	-	0.10	-	0.10
PCT pharmacist advisers	40	152	-	1	-	0.02	-	0.02
Consultants (NHS)	137	196	47,550	1	All remainder	0.08	3.24	3.32
Registrars (NHS)	59	196	-	1	-	0.03	-	0.03
Hospital admin staff (NHS)	33	196	-	1	-	0.02	-	0.02
Nurse consultants (NHS)	33	196	1,493	-	All group	-	0.02	0.02
Total NHS						**3.99**	**5.04**	**9.04**

Persons	Hourly cost per person (£)	Number of organis-ations	Number of persons	Persons reading full strategy per org	Persons reading executive summary per org	Cost of reading full strategy (£m)	Cost of reading executive summary (£m)	Total cost (£m)
Consultants (non-NHS)	137	10	-	1	-	0.004	-	0.004
Registrars (non-NHS)	59	10	-	1	-	0.002	-	0.002
Hospital admin staff (non-NHS)	33	10	-	1	-	0.001	-	0.001
Farmers	9	222,700	-	50% of farms	All remainder	3.01	0.50	3.51
Vets	29	5,066	-	50% of practices	All remainder	0.22	0.04	0.26
Researchers	28	-	50	All group	-	0.004	-	0.004
Pharmacy researchers	28	-	42	All group	-	0.004	-	0.004
Total non-NHS						**3.24**	**0.54**	**3.78**
TOTAL NHS & non-NHS						**7.24**	**5.58**	**12.82**

Notes

(1) Hourly costs of NHS time from PSSRU Unit costs of Health and Social Care 2011 per hour of activity, excluding training costs. Private costs assumed to be the same.

(2) Hourly wage for senior farmer (Band 5) from DEFRA report “Farm Labour and Wage Statistics 2012”

(3) Average basic salary of veterinarians working in the sector from “The 2010 RCVS Survey of the UK Veterinary and Veterinary Nursing Professions””

(4) Average salary of full-time academic staff (2011) from Times Higher Education report on “Average Salary of Full Time Academic Staff 2010/11”

(5) Number of GP surgeries from NHS Information Centre (for England; other data from Wales, Scotland and Northern Ireland from equivalent providers)

(6) Number of NHS hospitals from NACS (for England; other data from Wales, Scotland and Northern Ireland from equivalent providers); number of private hospitals calculated by assuming the same ratio for non-NHS to NHS as for the number of admissions (from Laing's Healthcare Market Review 2011-12)

(7) Number of relevant farms in England from Farm Business Survey 2010/11 (www.www.farmbusinesssurvey.co.uk), factored up to UK based on population (http://cdn.hm-treasury.gov.uk/sr2010_fundingpolicy.pdf)

(8) Number of veterinary practices from Royal College of Veterinary Surgeons report “RCVS Facts 2012”

(9) Number of NHS staff from NHS Information Centre (for England; other data from Wales, Scotland and Northern Ireland from equivalent providers)

(10) Number of researchers based on internal expert opinion

* Figures may not sum due to rounding

(a) Monitor current levels of resistance in specific microbe-drug combinations – costs

70. Any costs incurred, will be incurred voluntarily. There are approximately 206 acute trust laboratories, of which 10 are private sector.[5] Current estimates from PHE suggest that 80-90% of laboratories routinely report clinically significant bacteraemia, and 70-80% of these provide susceptibility data to PHE. Therefore, around 62 laboratories would need to introduce this type of reporting (three of these being private). This would require altering their data extracting process from the lab system. Estimates from PHE suggest that such an alteration would involve a one-off cost of half a day of qualified scientist staff time in year one, at an hourly cost of £41.[6] This suggests a total cost of around £8,000 in year one only across all relevant laboratories (around £400 of which would fall on the private sector).

71. Further costs will be incurred for changing the testing of gonorrhoea samples. Separate isolates will need to be sent for these, of which PHE estimate there are about 15,000 samples a year (overwhelmingly from NHS-based organisations, not private sector ones). Estimates from PHE suggest this will cost approximately £10 per sample to the sending laboratory, in terms of materials and technician time. Therefore, there will be ongoing costs of around £150,000 per year. In addition to NHS laboratory costs there will be resource implications for PHE in collation and analysis of the data and gonorrhoea samples. This is expected to require a total of five days of consultant time (valued at an hourly rate of £137)[7] and five days of qualified scientist time (valued at an hourly rate of £41) each year. This totals £7,000 p.a. Therefore, the total costs of gonorrhoea testing are therefore expected to be approximately £157,000 per year, falling on the NHS.

72. The total cost for this action would be around £160,000 per year (taking into account the costs to laboratories and PHE in reporting susceptibility and reporting and testing gonorrhoea samples). Over ten years, the total cost would be £1.4m, when discounted at 3.5% per year. Of this, the cost to the private sector would only be in the region of a few hundred pounds per year, with a total discounted cost over ten years of around £3,000.

(b) Improved uptake of Start Smart Then Focus in secondary care – costs

73. Any costs incurred, will be incurred voluntarily. The reviews of antimicrobial practice following Start Smart Then Focus may require one consultant and one administrative staff member for this period of time each. With an hourly cost for a consultant of £137 and a member of administrative staff of £33,[8] the cost of a short review would be around £850 and a longer review £1,700. Assuming that half of the 196 NHS acute trusts require a longer review, the one-off cost to the public sector would be around £250,000. Assuming a similar split in the private sector of ten organisations, the cost would total £13,000 in year one only.

74. There will be increased time costs for consultants due to this rise in documentation. While the amount of time may be small for each course of antibiotics, there are a substantial number dispensed in hospitals. The Point Prevalence Survey[9] found that approximately 26,000 antibiotics were prescribed among the 52,000 patients investigated, suggesting that around 0.5 antibiotics are prescribed per patient investigated. With 14.9m admissions to NHS hospitals in 2010/11,[10] this implies around 7.4m antibiotics may be used each year. Evidence from the joint ESCMID-ISC survey on Antimicrobial Stewardship suggest that less than 80% of those surveyed in hospitals fully documented the indication and duration of prescribed drugs. Therefore, it is plausible that this policy may increase documentation in around 10% of all cases, i.e. amongst

[5] Based on sources from the previous section

[6] Based on PSSRU 2011, the median full-time equivalent basic salary for Agenda for Change Band 6 of the January-March 2011 NHS Staff Earnings estimates, plus additional costs as for a hospital scientist

[7] Based on the mean total earnings of a medical consultant, from the source in the previous section

[8] Based on the sources of the previous section

[9] www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/HCAI/HCAIPointPrevalenceSurvey/ (main publication, p.44)

[10] Total admissions from Hospital Episode Statistics (2010/11)

0.7m antibiotics. This increased documentation is relatively small, so an indicative figure of a minute of extra time is used. This would translate into 14,000 consultant-hours, valued at around £137 per hour.[11] This suggests an ongoing cost of £2.0m per year for NHS hospitals.

75. Private sector hospitals have approximately 0.90m admissions per year.[12] This represents approximately 5.1% of the admissions to NHS hospitals. Assuming a similar response in private sector hospitals would suggest that they may incur around 5.1% of the costs that NHS hospitals incur in total. This would suggest an ongoing cost of around £0.1m per year. It should be noted that this is not a regulatory requirement, so private hospitals would not be required to comply with this, although it is expected that they would choose to do so.

76. There will also be ongoing costs from annual audits of antimicrobial use. This IA assumes that around 10% hospitals will introduce annual audits as a result of the publication of this strategy. Each audit may take one hour of consultant time (valued at £137 per hour) plus four hours of administrative staff time (valued at £33 per hour). This totals around £270 per hospital, and £5,300 overall. There will be further costs in disseminating this information across the hospital. This IA assumes that each consultant will require half an hour to take in the results of the audit (either through a short presentation or reading a short report). Assuming that 10% of the 47,550 consultants spend this time, the cost would be £326,000 per year. The total cost on these NHS institutions is therefore around £331,000 per year. Assuming a similar split between the NHS and non-NHS, there would be further costs to private organisations of £17,000 per year.

77. The total cost of this area is therefore likely to be in the region of £2.5m per year, with an additional £0.3m in year one. This takes into account the one-off and ongoing costs of reviewing procedures and the ongoing cost of increased time in documenting prescribing. Over ten years, the total cost would be £21.4m, when discounted at 3.5% per year.

(c) Improved uptake of Start Smart Then Focus in secondary care – benefits

78. Improved quality of prescribing would reduce the amount of time patients' suffer infection and prevent the onset of other infections, thereby improving their quality of life and reducing their length of stay in hospital (freeing up resources to be used for other patients).

79. One area where improved quality may have a measurable impact is in the treatment of sepsis. Patients with sepsis will spend extended periods of time in critical care beds, with organ support required. The average cost to the NHS of a critical care bed is £1,200 per day.[13] There are around 25,000 cases of septicaemia each year that may be affected in England.[14] While it is not known how many of these would be affected, or for how much time, it is plausible that 5% of these patients may benefit from around two fewer days in critical care. This would suggest ongoing cost savings of around £3.1m per year in England. Assuming that a similar proportion of the population would fall into this category in Wales, Scotland and Northern Ireland, cost savings may total £3.6m per year for the UK as a whole.[15] There would be further health benefits that are not monetised here. The total quantifiable benefit of this action over ten years may be around £36.3m, when discounted at 3.5% per year.

[11] Based on the sources of the previous section
[12] Laing's Healthcare Market Review 2011-12
[13] Based on an average cost of the different levels of support (from zero to six organs), weighted by activity, from NHS reference costs (2010/11).
[14] Based on long stay non-elective inpatient activity levels for septicaemia with intermediate and major complications (WA03V and WA03X) from NHS reference costs (2010/11)
[15] Based on population estimates used to inform Government funding (http://cdn.hm-treasury.gov.uk/sr2010_fundingpolicy.pdf)

(d) Improved usage of Target web-based tool by GPs – costs

80. Any costs incurred, will be incurred voluntarily. Acquainting themselves with the tool will take a small portion of GPs time. There are around 43,000 GPs in the UK.[16] This Impact Assessment assumes that around 10% would review the Target tool, which would represent 4,300 individuals. Assuming that it takes each GP an hour to acquaint themselves with the tool, with an hourly cost of £83,[17] this will result in a one-off cost in year one of £360,000.

81. There are expected to be further ongoing costs as GP surgeries audit their antimicrobial use each year. This is expected to require four hours of administrative staff time per year (valued at £33 per hour)[18] and an hour of GP time per year (valued at £83 per hour). The total cost per year per practice would be approximately £200. Assuming that this affects 10% of the total 10,185 practices in the UK, this translates into a total ongoing cost of £220,000m per year.

82. These lead GPs would also cascade this information to other GPs in the practice, as well as all practice nurses. This would take around half an hour of these staff members' time each year. With around 43,000 GPs (who have an hourly cost of £83) and 25,000 practice nurses (who have an hourly cost of £33), the total cost of this would be around £220,000 per year.

83. When taken over ten years (discounted at 3.5%), the total cost is around £4.1m. There are no costs on the private sector.

(e) Improved antimicrobial stewardship in farmed animals sector – costs

84. Any costs incurred, will be incurred voluntarily. Following the publication of the strategy, it is expected that farmers will review their antimicrobial stewardship programmes. While it is not known how many farmers would undertake such reviews, this Impact Assessment makes a number of assumptions to produce some indicative costs. Approximately 10% of all farms may undertake a short review, lasting around 5 hours, with a further 10% undertaking a longer review of around 10 hours. There are approximately 222,700 grazing and dairy livestock farms in the UK. The wage of a senior farmer is approximately £9.00 per hour.[19] Therefore, the total cost of this review will be around £3.0m. This will occur in year one only, and there are not expected to be any further substantial ongoing costs. It should be noted that this is not a regulatory requirement, so farmers would not be required to comply with this, although it is expected that they would choose to do so.

Sensitivity Analysis

85. This section shows some brief sensitivity analysis results. As the benefits are likely to be in the region of billions per year (as described in the main section), even substantial changes in the assumptions make no material impact on the overall net benefit of the strategy. The following table demonstrates the effects of changing a number of the assumptions on the gross costs of the strategy over ten years. In the base case these are £44.1m (when discounted at 3.5% per year). Any costs incurred, will be incurred voluntarily. These changes should be understood in the context of the likely billions of pounds worth of benefits per year.

[16] Headcount number of all General Practitioners, as at 2011 (www.ic.nhs.uk)
[17] Sources from the 'publication' section
[18] PSSRU 2011, per hour of a Band 5 GP practice nurse (assumed to be the same as an admin staff member in the PSSRU publication)
[19] Hourly wage for Band 5 farmer from DEFRA report "Farm Labour and Wage Statistics 2012"; number of farms with dairy and livestock from Farm Business Survey 2010/11 (www.www.farmbusinesssurvey.co.uk)

Assumption	Base case value	Sensitivity value	Gross costs (£m)	Percentage increase from base case
Base case	-	-	42.8	-
Time taken per person to read and digest strategy	3 hours	6 hours	50.0	16.9%
Percentage of farms that read strategy	50%	100%	45.8	5.9%
Time needed per laboratory per year to report susceptibility	3 hours	10 hours	42.9	0.4%
One-off time per person per hospital to review Start Smart, Then Focus	5 hours for half hospitals, 10 hours for other half	20 hours for all	43.2	1.0%
Ongoing time per hospital to review antimicrobial use	1 hour (consultant) 4 hours (admin)	5 hours (consultant) 20 hours (admin)	43.0	0.4%
Time needed per antimicrobial to ensure full documentation	1 minute	2 minutes	60.9	42.4%
One-off time needed per GP to review Target	1 hour	4 hours	43.9	2.5%
Ongoing time per practice to review antimicrobial use	1 hour (GP) 4 hours (admin)	4 hour (GP) 20 hours (admin)	50.3	17.6%
Percentage of farms reviewing their antimicrobial stewardship	10% (short review) 10% (long review)	20% (short review) 20% (long review)	45.8	7.0%
Time per farm to review antimicrobial stewardship	5 hours (short) 10 hours (long)	10 hours (short) 20 hours (long)	45.8	7.0%

Annex B: Microbe-Drug combinations

Microbe	**Drug**	**Relevant population**
Klebsiella	Carbapenem	% non-susceptible to imipenem and/or meropenem
E. coli	Carbapenem	% non-susceptible to imipenem and/or meropenem
E. coli	Cephalosporin	% non-susceptible to cefotaxime and/or ceftazidime
E. coli	Fluoroquinolone	% non-susceptible to ciprofloxacin
Pseudomonas	Carbapenem	% non-susceptible to imipenem and/or meropenem
N. gonorrhoeae	Ceftriaxone	% non-susceptible
Klebsiella	Cephalosporin	% non-susceptible to cefotaxime and/or ceftazidime
Pseudomonas	Cephalosporin	% non-susceptible to ceftazidime
E. coli	Gentamicin	% non-susceptible
S. pneumoniae	Penicillin	% non-susceptible