



RMS WHITE PAPER

## **LONGEVITY RISK THE IMPACT OF DAILY ASPIRIN INTAKE ON PENSION LIABILITIES**

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Recent medical reports have added to the growing body of evidence that taking low dose daily aspirin reduces cancer mortality, in addition to its known benefits for cardiovascular health. This news could lead to many more people taking daily aspirin, particularly pensioners. This report presents an analysis of the potential impact on pension liabilities from annuitants taking up the habit of daily aspirin, with different scenarios for speed of uptake and penetration rates. Daily aspirin taking could increase liabilities more than if everyone rapidly gave up smoking.





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## Executive Summary

Recent evidence of aspirin’s anti-cancer effects suggests there are potential health benefits from taking daily low dose aspirin. Experts now believe that around 15% of current cancer deaths could be prevented by daily aspirin use, with benefits beginning as early as three years into treatment. Conventional cancer treatments are expensive and a new treatment typically requires a lengthy regulatory approval process. By contrast, aspirin is readily available and cheap and so has the potential for rapid uptake. Widespread aspirin use could have a measurable impact on mortality rates within the financial duration of annuity portfolios.

RMS modelled four potential aspirin uptake scenarios with two key assumptions: population penetration—the proportion of the population not already taking aspirin that would be willing and medically able to comply with a regimen of daily aspirin—and adoption rate. The results of these scenarios are summarized in [Table 1](#). Widespread aspirin use could cause an estimated increase in liability of up to 0.7% in U.K. males. This corresponds to around the same level of impact on a pension scheme if everyone rapidly gave up smoking.

In life expectancy terms, this impact is roughly equal to the average annual increase in life expectancy from all drivers of mortality improvement over the past 50 years. The increase in aspirin uptake could have an even more profound impact on deferred annuity portfolios, because younger people are more likely to benefit from aspirin treatment.

The benefit of aspirin for an individual depends on a variety of factors such as smoking, family history, and side effects. Although on a portfolio level, the overall impact is modest, for individuals, daily aspirin use could have a significant impact. A typical 65-year-old male could see a 12-month increase in mean life expectancy and a 40% increase in the chance of living to 100.

**Table 1: Impact of Aspirin Use on a U.K. Male Pension Fund**

Scenario	Years to 90% Adoption	Penetration	Life Expectancy Change* (years)	Annuity Factor Change*
Rapid Aspirin Uptake with Very High Penetration	20	75%	0.21	0.7%
Moderate Aspirin Uptake with Very High Penetration	50	75%	0.10	0.3%
Rapid Aspirin Uptake with Moderate Penetration	20	40%	0.03	0.1%
Moderate Aspirin Uptake with Moderate Penetration	50	40%	0.00	0.0%

\*Relative to moderate assumptions



## The Science of Aspirin

Aspirin was originally trademarked and sold around the world to help alleviate headaches, pains, and fevers more than a century ago. Its application in preventative risk reduction for cardiovascular disease has long been known, and it has been in routine use since the late 1980's. The potential for aspirin to have a protective effect for colorectal cancers was observed soon after, but the scale of its benefits in overall cancer prevention is unexpected.

Three new studies published in *The Lancet* add to mounting evidence of aspirin's anti-cancer effects and increasing interest in the potential for low dose aspirin to prevent cancer. It is already known that aspirin prevents deaths from bowel cancer, though the scale of the benefit and harm of side effects is not entirely clear. Since 2010 studies have shown aspirin affects a broader range of cancers, not just bowel cancer, and the effect is greater than anticipated. It is likely that low dose aspirin will be adopted for routine prevention and treatment of certain types of cancer in the future in certain at-risk groups.

### What do the new studies show?

#### Reduced cancer rates

The research suggests that daily low dose (75mg) aspirin reduced all cancer mortality by 15-23% during clinical trials.<sup>(1)(5)(6)</sup> There was about one-third fewer deaths in patients after 5 years of treatment. Analysis of different cancer types revealed that aspirin taken for at least 5 years or more, halves the risk of colorectal cancer and gastrointestinal (GI) cancers in general. The surprisingly large effect on colorectal cancer confirms and extends previous observations, whereas the significant effects on other GI cancers (e.g., pancreatic and esophageal cancers) are novel. Looking at the longer-term, researchers observe that the anti-cancer effects of aspirin were maintained on GI cancers, but also found that it significantly reduced certain non-GI cancer deaths. In particular, 20-year lung cancer risk was reduced by more than 25%. Looking further into the biological mechanism for these effects, the researchers discovered that the reduction in mortality from cancers almost exclusively applies to one particular sub-type called adenocarcinoma. Adenocarcinoma is a type of cancer that arises from glandular cells lining organs and cavities like the GI and respiratory tracts.

Lung cancer is an example of a cancer where a growing proportion of cases may be amenable to daily low dose aspirin use. Lung cancer is divided into two main groups, small cell lung cancer and non-small cell lung cancer. Adenocarcinoma, one of the main types of non-small cell lung cancer, accounts for about a third of all cases of lung cancer. Most of the rest of the cases are accounted for by squamous cell carcinoma (SCC), often attributable to smoking, and small cell carcinoma. Prevalence data shows that the proportion of adenocarcinomas is rising. This is consistent with the decline in smoking rates, as other types of lung cancer are more closely related to a history of smoking: as the number of smokers fall, so too does the number of people with SCC. Because the risk reduction due to aspirin use is over 40% in adenocarcinoma, but is negligible in SCC, the implication is that aspirin use has the potential to become increasingly effective in controlling lung cancer.

Research also showed that the aspirin-cancer mortality benefit is independent of the dose above a relatively low threshold of 75 mg. This is important as the risk of side effects is lower with smaller doses, and there is clearly no need to use higher doses for cancer prevention.



### Duration of use and lag time

The research showed there is a lag of about five years before aspirin begins to reduce mortality for colorectal, oesophageal, and lung cancers and up to 10 years for stomach cancer. This suggests that aspirin has only a limited effect on established cancers that would lead to death in the first few years, but may selectively inhibit the development, growth and spread of very early cancers. In other words, long-term use of aspirin probably prevents the emergence of new cancers, but probably doesn't reduce mortality from more advanced cancers that have already spread to other parts of the body. Considering that the benefit is sustained well beyond the treatment period in evaluable studies, such an argument seems well supported. It may be that different aspirin mechanisms operate for different cancers. In lung cancer sufferers, for example, there is some weak evidence that progression is slowed by aspirin, not just the development of cancer.

The main implication of this finding is that an individual needs to take daily aspirin for at least five years to experience any reduction in cancer mortality, and the longer it is taken, the better. Importantly, the study found that even those subjects in the trial who stopped taking aspirin after 5 years still had a major risk reduction at 20 years. This suggests that if any rebound rise in cancer risk occurs upon stopping aspirin, it is delayed at least 15 years; unlike the taking of aspirin to prevent cardiovascular death, where a rebound increase in mortality is seen much sooner, negating much of the benefit.

Not all people will benefit equally from the cancer mortality reduction. Some groups are at a higher risk of cancer and will therefore benefit disproportionately. For example, smokers have higher rates of cancer (and cardiovascular) risk, and so are likely to experience the greatest absolute reduction in risk. It is clear that some subgroups, such as female non-smokers under 60, would not realize an immediate benefit from aspirin use, as the increase in deaths from hemorrhagic stroke and peptic ulceration would exceed the reduction in cardiovascular and cancer deaths in the short term.

### How new is this news?

Aspirin is already well known for its benefits in treating cardiovascular disease. It has contributed significantly to mortality improvement since the late 1980s, when it was shown to reduce death from ischemic heart disease in those who had a history of myocardial infarction. Since then, its effectiveness in an increasing number of cardiovascular diseases has been demonstrated. Its additional benefit in reducing cancer mortality was unexpected.

Earlier studies show that aspirin reduces mortality from colorectal cancer, though it has not previously been clear whether the scale of the observed improvement compensated for the drug's side effects – an increase in the risk of hemorrhagic stroke or bleeding peptic ulcers. Reduced rates of various other cancers in people who regularly take aspirin have also been noted in a few case-control and observational studies, but the level of evidence has been insufficient to draw firm conclusions about cause or effect. The new research published in 2012 makes it possible to estimate the effects of daily aspirin on mortality rates and to demonstrate that the benefits outweigh potential risks for a large number of people. It is likely to result in many more people taking daily aspirin.

### How did they do it?

The researchers that did the first study in 2010 used a shrewd analytical strategy to reveal the impact of aspirin on cancer risk using existing clinical trial data. Firstly, they performed a meta-analysis (a statistical analysis of data aggregated across a number of clinical trials) on



long-term randomized trials of daily aspirin versus placebo in patients with increased vascular disease risk. Because the cause of death was meticulously recorded in these trials, the researchers were able to leverage the results from this series of large, high quality trials to estimate the risk of dying of cancer for those taking aspirin compared to those taking a placebo. Due to the large number of patients (over 25,000), they identified the substantial anti-cancer effect of aspirin with a very high degree of confidence. Next, the authors conducted a series of pooled analyses on data from trials where individual patient data was maintained longitudinally, in some cases for up to 20 years. This allowed them to dissect the aspirin-cancer effect, revealing the tissues and cancer types most impacted, the latency period of the mortality reduction, and the mortality benefit realized by different age groups.

### How reliable is the new evidence?

These studies were meta-analyses of existing data from randomized controlled trials of patients primarily aged 50-75. Meta-analysis is considered to be more reliable than single trial data as there are larger numbers of patients. A potential weakness of meta-analyses like this is “publication bias” that arises from the selective publication of positive results (publishers are less interested in negative results). In this case, however, the outcome of interest—the impact of daily aspirin on cancer mortality – was not the focus of the original trials, making it less likely that publication bias or selection bias would affect this analysis.

The Women’s Health Study and the Physician’s Health Study have also investigated the effectiveness of aspirin in preventing cancer. These studies conducted randomized controlled trials of alternate daily aspirin, and failed to find a reduction in cancer risk.<sup>(7)(1)</sup> The inconsistency between these studies and this meta-analysis appears to be linked to the frequency of taking aspirin – the authors of The Lancet study conclude that, to be effective, aspirin dosing needs to be daily rather than on alternate days, though there may be other explanations.

### What does aspirin do?

Aspirin is a non-steroidal anti-inflammatory drug (NSAID). NSAIDs block the action of cyclooxygenase (COX), an enzyme involved in the synthesis of hormones such as thromboxane, prostaglandins, and prostacyclin. These hormones, “prostanoids,” mediate the inflammatory response and affect the clotting of blood. By inhibiting thromboxane production in platelets the ability of the blood to clot is reduced, helping to prevent thrombotic cardiovascular events like heart attacks and ischemic strokes, but at the expense of increasing the risk of bleeding into critical sites like the brain (hemorrhagic strokes) or the gastrointestinal tract.

It is less well understood how aspirin might prevent cancer, but it appears that aspirin reduces the risk of a type of cancer called “adenocarcinoma.” As explained previously, these are cancers that arise from the glandular cells lining organs and cavities like the GI and respiratory tracts. Prostaglandins appear to promote the formation of polyps, fleshy outgrowths from the linings of these tubes, from which adenocarcinomas frequently develop. By preventing polyp formation, the risk of cancer is therefore reduced. The mechanism in preventing polyp formation is not yet clear, but probably relates to COX inhibition.

Also, prostacyclin stimulates the production of new blood vessels (angiogenesis), which is an important auxiliary process in promoting cancer growth. Aspirin reduces prostacyclin production which could make it harder for cancer cells to survive, or at least retard their growth.



## Risks of aspirin taking

Aspirin can cause side effects. It can cause bleeding in the stomach and elsewhere, which is occasionally fatal. For a 65-year-old man taking aspirin daily, there is a mortality risk of about 4 in 10,000 attributable to aspirin. This increases rapidly with age, until the risk at age 85 is around 20 in 10,000. However, when compared to the number of deaths from cancer (61 and 250 respectively), the risk of death from gastrointestinal bleeding would have to rise several hundred percent before it would negate the reductions in death from cancer. In any case, the risk of catastrophic bleeding is highest shortly after starting aspirin, and is barely any different in long term users—another finding from the recent analyses.

A significant proportion of people may be unable to take aspirin for a variety of reasons:

- People who suffer from indigestion or have a history of peptic ulcer disease.
- People with liver failure who have a higher risk of bleeding
- People with kidney disease where aspirin can reduce kidney function
- People with asthma. Some people are allergic to aspirin, which may aggravate the condition more.

There are no definitive statistics on the number of people who would be unable to take aspirin for medical reasons, but this is estimated for the modeling below.

Even though some people are intolerant of aspirin alone, those who get indigestion as a side effect can be treated with acid suppression drugs to enable them to continue taking it. A common stomach infection, helicobacter pylori (H pylori), increases the risk of bleeding in the stomach, and has been suggested that testing people who take aspirin and treating them to eradicate H pylori if it is present would successfully prevent this problem.(8)(9) However, the evidence is not clear. One study suggests there is a reduction in bleeding in patients taking NSAIDs with ulcers.(10). The mechanisms involved in causing stomach bleeding in those with H pylori and those taking aspirin are different, and a recent analysis suggests that there was no significant reduction in risk from eradicating H pylori in those taking NSAIDs like aspirin, even though there is a big reduction in those who are H pylori positive and don't take NSAIDs.(11) A reasonable conclusion would be that it is sensible to eradicate H pylori, which will then reduce the risks arising from H pylori infection but will not negate the effect of aspirin.

## Analysis of the Implications

RMS models the likely progression and impact of new medical breakthroughs in longevity risk. Using the newly published data from Rothwell et al., RMS used medical-based modeling to analyze the impact of increasing numbers of people taking daily aspirin in a number of scenarios to assess the potential impact of this new development on pension liabilities in the U.K.

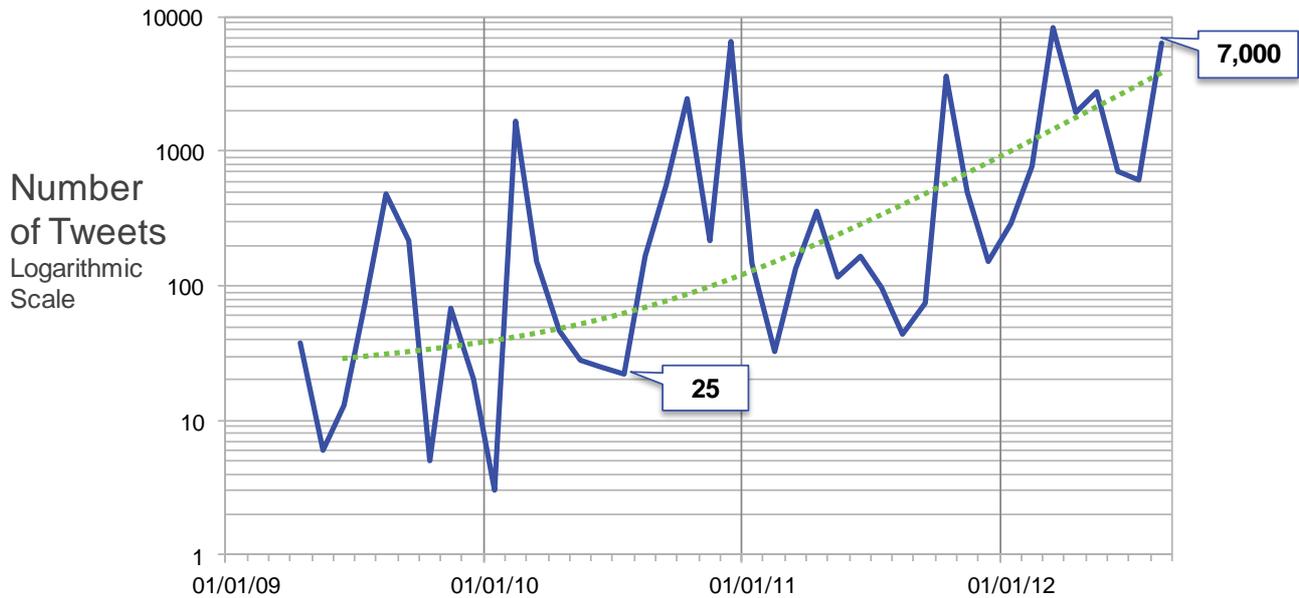
### What is likely to happen as a result of this research?

RMS believes that the consequences of this research are likely to be that many more people will decide to take daily low-dose aspirin. Doctors will be more likely to advise higher cancer risk individuals, such as smokers, that they should be taking daily aspirin; and they are likely to recommend daily aspirin to older individuals more generally, beyond those with heart conditions that are currently advised to take aspirin. The balance of risk has shifted



significantly for most of the population, from the risk of side effects to the benefits it provides in cancer suppression.

**Figure 1: Monthly Counts of Tweets Mentioning “Aspirin” & “Cancer”**



Unlike other medical breakthrough drugs, aspirin is a well-known entity and thus will not have to go through lengthy trials before being approved for use, so there is no enforced delay between the demonstration of efficacy and drug availability.

Aspirin is relatively cheap – a few cents or pence a dose – and is readily available over the counter in every pharmacy. In the U.S. there is no restriction on purchases, but in the U.K. and a number of other countries, there are limits to the number of doses that can be purchased at one time as a result of anti-suicide measures introduced in 1997, but this is unlikely to prevent people obtaining regular supplies.

There are likely to be early adopters who will start taking aspirin immediately, and others who will wait for further studies, government policy pronouncements, or additional confirmation such as long-term safety data from large scale randomized controlled trials. Unfortunately, the existing widespread use of aspirin, and the likelihood that individuals may start to take it for cancer prevention on their own initiative may make it impossible to carry out a reliable trial.

Both public and medical attitudes to medicines are conservative, and adoption will be slow. At some point there will be a tipping point of awareness and evidence that will result in mainstream acceptance of the use of aspirin for cancer prevention. Figure 1 above shows the exponential growth in Twitter posts discussing aspirin and cancer and is standardized by the number of Twitter users. Signs that we may be approaching that tipping point include a statement by the U.K. Department of Health that it would be actively examining the evidence to determine how best to advise the public.(12)



## RMS Analysis

RMS performed a deterministic analysis of mortality by cause of death on a standardized synthetic pension portfolio from ages 40 to 95 years, and projected forwards seventy years. The impact of additional aspirin use over the current prevalence was determined under a range of scenarios taking account of both beneficial effects (on cancer and cardiovascular disease) and negative effects (on hemorrhagic stroke and peptic ulceration). Important features such as the lag time on the impact on cancer mortality, limitations on consumption imposed by aspirin sensitivity, and plausible compliance rates were taken into account. Cause-specific hazard ratios were assumed to be age-independent, as they were measured for ages (50+) at which deaths were most prevalent.

### Penetration levels

Many people already take a regular dose of aspirin. In the U.S. half of those 65 and older “regularly” consume aspirin. (13) Not all of these may take it daily however, and for the cancer mortality benefit, it appears to be necessary to take it daily. If only half of the “regular” users take it daily, then 25% of the elderly U.S. population are already benefiting.

In the U.K., studies from the *General Practice Research Database* suggest daily aspirin use reaches about 20% for individuals over 80.(14) For the U.K., RMS modeling assumes that 1% of 40-year-olds already take daily aspirin, rising to 4% for individuals aged 50, and 20% for 70, peaking at 30% at age 80 after which there is a gradual decline. A proportion of the population is unable to take aspirin, for reasons described on page 7. It is possible that these individuals could potentially take it with additional treatments to control for side effects, but for the purposes of this analysis, it is reasonable to assume that there will be a core of people that will not take up daily aspirin.

The 2010 Rothwell study suggests that aspirin needs to be taken daily and to be sustained for five years to receive the benefits identified. Compliance with these requirements may be difficult to sustain. Aspirin compliance levels are likely to be similar to those recorded for other long term drugs prescribed by physicians.

In the modeling, two options are considered for the extent of uptake of the treatment among the proportion of the population not already taking daily aspirin. The penetration levels modeled are 75% (i.e., 25% of the population is unwilling to take it or to comply with daily treatment), a very high penetration, and 40%, a more moderate scenario.

### Speed of uptake

The speed of uptake of the treatment by the population is a very important variable for how quickly the resultant improvements will be seen in mortality rates. Historically, new treatments have always taken time to be adopted, and to percolate through to large numbers of the population. Precedents show that early adopters of a treatment or lifestyle change tend to be better educated, more aware, and come from wealthier sectors of society, but over time treatments become accepted practice by most of the rest of the population. Slower uptake is due in part to an aversion to taking medicines, natural caution about unproven techniques, fear of hidden risks, and in part a lack of awareness of the benefits and general organization capability to exploit benefits where they are recognized. Patterns and timing in the uptake of health-related lifestyle choices and taking action to improve life expectancy can be seen in the evidence of social statistics such as those for immunization rates, quitting smoking, and access to new medical technologies.



The uptake of daily aspirin is likely to follow some of these precedents in the time it takes for high levels of the population to adopt the habit. RMS modeled two different time periods for adopting a daily aspirin habit: in the high uptake scenario, 90% of the effect of aspirin on mortality is realized after 20 years, and in the moderate uptake scenario, 90% of the effect is realized after a protracted 50 year adoption period.

### What impact might this have on mortality improvement rates?

RMS medical-based modeling has been used to assess the potential impact on pension schemes and pensioner members of the aspirin effects observed in 2012 Rothwell analysis .

Table 2 below shows the life expectancy metrics for different types of 65-year-old pensioners, assuming no other cause of mortality improvement.

The benefit is a year of improved life expectancy for men, and six months for women. The results can be seen most prominently in long-term survival, with men becoming more than 40% more likely to become a centenarian.

**Table 2: Impact of Taking Daily Aspirin on 65-Year-Old Mortality Metrics**

	65-year-old in normal health, not taking aspirin			65-year-old who has been taking aspirin for 5 years (since age 60)			Improvement from taking daily aspirin		
	Period Life Expectancy	Probability of living to 80	Probability of living to 100	Period Life Expectancy	Probability of living to 80	Probability of living to 100	Period Life Expectancy Gain (yrs)	Increase in Prob. of living to 80	Increase in Prob. of living to 100
Male	82.3	60%	1.0%	83.3	64%	1.4%	1.0	+6%	+42%
Female	85.2	72%	2.5%	85.7	74%	3.0%	0.5	+3%	+21%

Abbreviations: Prob., probability



## Timelines for mortality improvement to materialize

Using cancer estimates from the 2012 Rothwell study, RMS models that daily aspirin's effect on cardiovascular and cancer deaths would reduce all-cause mortality by about 10% after adjusting for increases in deaths caused by side effects of aspirin such as hemorrhagic stroke. However, this depends on individual risks for cardiovascular disease and cancer, and both age and gender have a significant impact on these causes of death. Figure 2 shows the expected mortality difference for a 65-year-old male and a 45-year-old female who start to take aspirin.

Figure 2 also shows that the peak mortality reduction occurs in roughly 10 years time for a 65-year-old male, and after 20 years for the 45-year-old female. These timelines are significant for annuity and pension portfolios, as even with heavily discounted run-off values, they will still impact present-day liability valuations.

Figure 2: Timeline of Mortality Differences that can be Expected to Result From Daily Aspirin

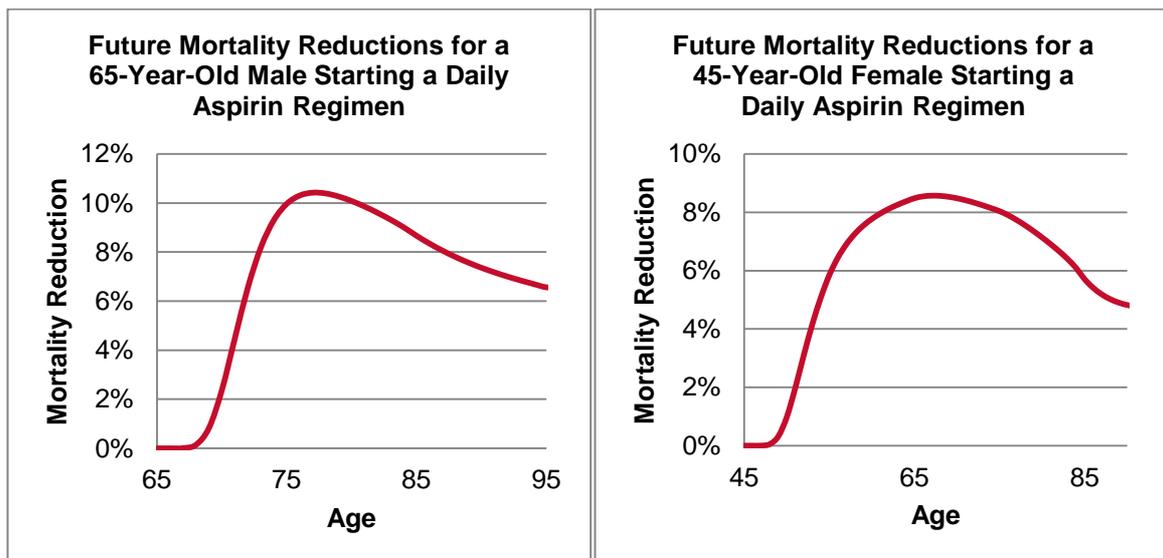


Figure 3 shows the effective portion of 60-year-old males that are benefitting from aspirin use in both the high and moderate uptake and penetration scenarios. Figure 4 shows the corresponding mortality improvement realized.



Figure 3: Effective Portion of 60-Year-Old Males Benefitting From Daily Aspirin

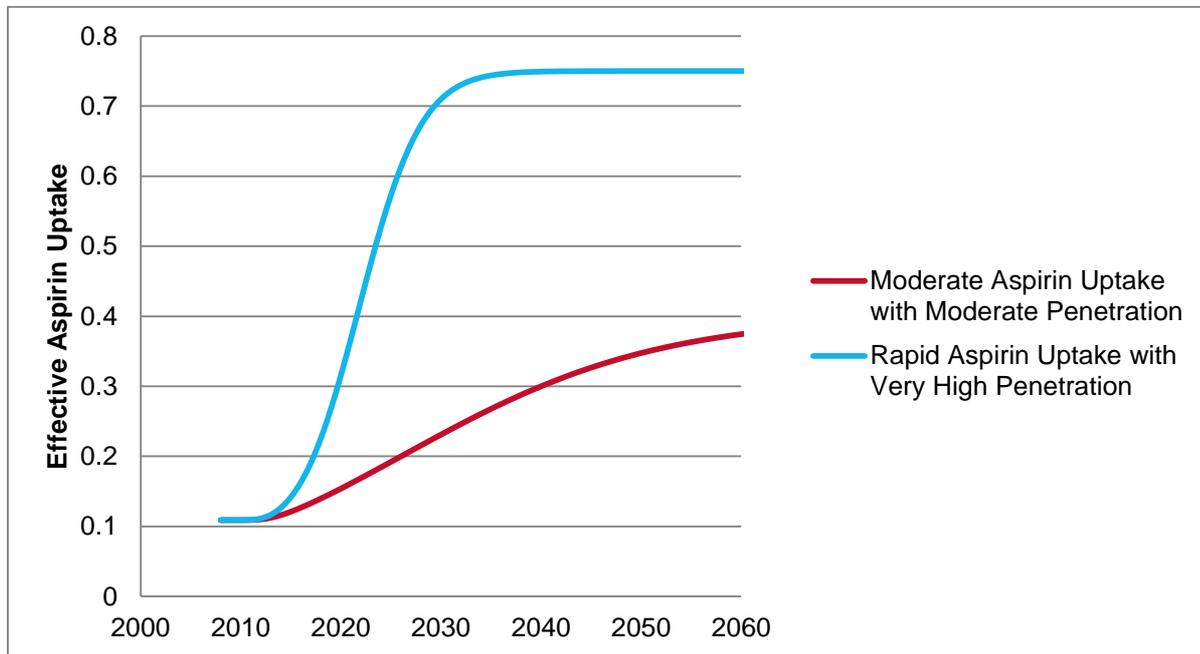
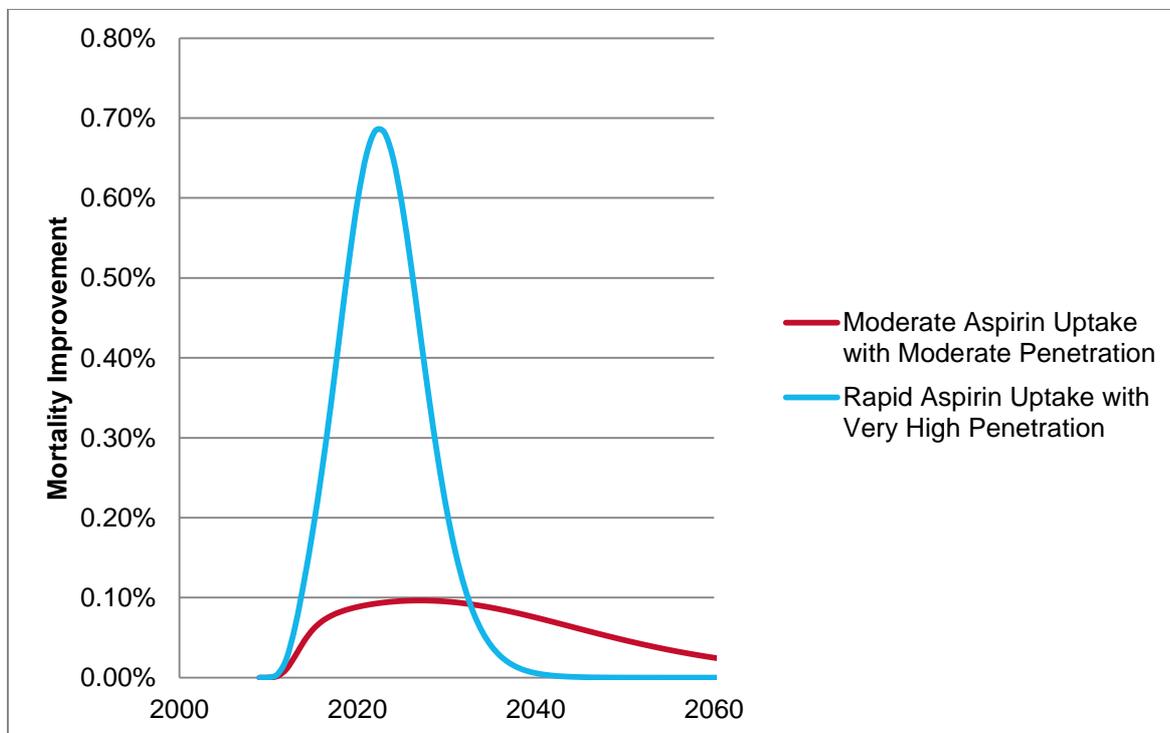


Figure 4: Mortality Improvement for 60-Year-Old Males From Daily Aspirin





## Model results for pension fund liabilities

The RMS<sup>®</sup> Longevity Risk Model enables scenarios such as the uptake of daily aspirin to be evaluated for their impact on mortality improvement and the implications for the liabilities of pension schemes.

Four aspirin uptake scenarios are considered: quick uptake of aspirin and high population penetration, moderate uptake and high population penetration, quick uptake and moderate penetration, and moderate uptake and moderate penetration. These scenarios are applied to the RMS Reference View, the standard view of the progression of mortality improvements in the U.K.; all other mortality improvement factors are assumed to be the same across all four scenarios. The RMS Reference View assumes some measure of progress with regards to the discovery and uptake of new and existing medical interventions. For this purpose, these scenarios assume that moderate uptake and penetration assumptions are already captured by the RMS Reference View mortality improvement rates.

### Sample Pension Membership

The following example uses a sample pension fund to illustrate the impact of the four aspirin use scenarios on life expectancy and annuity factors. The sample pension fund used assumes U.K. general population mortality rates and a normal exposure distribution with mean of age 65 and standard deviation of 10 years. The results are shown separately for males and females.

### Liability calculation

The pension fund membership mortality is simulated and the resultant survival curve is modeled through to complete run-off. A portfolio annuity factor is calculated for the scheme; i.e., the multiple of today's pension-in-payment value required to meet all future obligations, using a simple interest rate of 3%, and discount rate of 5% to arrive at a net present value, with no allowance for additional survivor benefits.

The purpose of the exercise is to illustrate the potential impact of aspirin-taking on pension liability and to review the sensitivities of different variables on that impact.

## Pension liabilities

Table 3 shows the change in life expectancy and liabilities across the sample pension portfolio across the four scenarios, for both genders. The results show that the maximum liability potential is a 0.7% increase for males and a 0.4% increase for females. For context, this is roughly the same liability potential as the eradication of smoking over the next 15 years. More modest assumptions in uptake and penetration levels yield diminished impacts. Actual liability increases for any specific portfolio will vary significantly depending on the age and gender structure of the pension scheme, and the heaviness of the mortality experience of the scheme.



**Table 3: Impact of Aspirin Use on a Sample Pension Fund, Relative to the RMS Reference View**

	Scenario	Years to 90% Adoption	Penetration	Life Expectancy Change (years)	Annuity Factor Change
Male	Rapid Aspirin Uptake with Very High Penetration	20	75%	0.21	0.7%
	Moderate Aspirin Uptake with Very High Penetration	50	75%	0.10	0.3%
	Rapid Aspirin Uptake with Moderate Penetration	20	40%	0.03	0.1%
	Moderate Aspirin Uptake with Moderate Penetration	50	40%	0.00	0.0%
Female	Rapid Aspirin Uptake with Very High Penetration	20	75%	0.13	0.4%
	Moderate Aspirin Uptake with Very High Penetration	50	75%	0.07	0.2%
	Rapid Aspirin Uptake with Moderate Penetration	20	40%	0.02	0.1%
	Moderate Aspirin Uptake with Moderate Penetration	50	40%	0.00	0.0%

## Contribution to Overall Mortality Improvement

The impact of the likely uptake of daily aspirin-taking has been studied by RMS to try to isolate its likely individual contribution to the general trend of mortality improvement. Aspirin uptake is, however, only one of several potential treatments, healthcare trends, and future medical breakthroughs that will contribute to an overall pattern of mortality improvement in the future.

For example, the recent period of high mortality improvement has largely been driven by improvements in the treatment of cardiovascular disease and reductions in mortality due to decreasing smoking habits and healthier lifestyles across the population.

Mortality levels in populations are not static, and vary considerably from year to year and change over periods of time with different lifestyle choices and medical treatments becoming available.

### The RMS modeling of future mortality improvement

There are many different drivers of mortality improvement; and RMS models longevity risk by considering a number of broad categories, within its Geroscience Advancement Stochastic Process model:



- **Lifestyle** – Changing attitudes towards fitness and personal health, including smoking, obesity, and health consciousness
- **Health Environment** – Healthcare provision and access, and the general environment of sanitation, care and living conditions
- **Medical Intervention** – Drug discovery and treatments to reduce the incidence of major causes of premature death
- **Regenerative Medicine** – Promising new treatments to repair damaged body systems and prolong life, for example stem cell therapy and nanomedicine
- **Anti-Aging Processes** – theoretical future treatments that may be able to change the biology of aging and extend healthy life

### Aspirin contribution within RMS modeling

Giving low dose daily aspirin is a medical intervention that will contribute to reducing the incidence of premature death resulting from a number of different types of cancers. Reduction of premature death from cancers is analyzed in the RMS modeling with a stochastic exploration of a wide range of timing and impact levels resulting from the application of many cancer treatment technologies currently under development. The widespread use of aspirin to reduce cancer mortality will contribute to this pattern of mortality improvement resulting from medical intervention. Aspirin uptake may increase the likelihood of some of the scenarios in the RMS model that anticipate rapid progress in cancer mortality reduction.

Deterministic scenarios available in RMS LifeRisks™ to model aspirin liabilities for your portfolio are shown in [Table 4](#).

**Table 4: Deterministic Scenarios in RMS LifeRisks™ to Model Aspirin Liabilities**

ID	Deterministic Scenarios
20220001	<b>Rapid Aspirin Uptake with High Penetration</b>
20220002	<b>Moderate Aspirin Uptake with High Penetration</b>
20220003	<b>Moderate Aspirin Uptake with Moderate Penetration</b>



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## Conclusions

The discovery that taking daily low-dose aspirin has a significant impact on reducing cancer mortality, in addition to its known benefits in reducing cardiovascular deaths, is an important event. It is likely to cause many individuals to re-evaluate the cost-benefit balance and lead to many more people taking aspirin daily.

The age profile of individuals who are likely to take up the daily aspirin is associated with younger members of pension schemes and those who will become pensioners in the next two decades.

The ready availability of aspirin and its low cost means that uptake could potentially be rapid, in contrast with other medical developments where new drugs and techniques need much longer timelines to become widely used. In the U.K., there is potential for a very significant increase in this practice. The benefits of taking aspirin are experienced after five years and are likely to be most significant in terms of the impact on pension membership mortality rates in 15 to 20 years' time.

The potential timeline for this mortality improvement means that it could have a measurable impact in increasing the net present value of liabilities for pension funds. Depending on the timing, compliance rates and other variables, net present values for liability (portfolio annuity factor) could be increased by 0.1% to 0.7% in sample pension portfolios that RMS modeled under a range of plausible scenarios.



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