Estimating the broader fiscal consequences of acute hepatic porphyria (AHP) in Belgium using a public economic analytic framework

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Abstract

Background

Acute hepatic porphyria (AHP) is a rare, debilitating disease characterized by potentially life-threatening attacks often resulting in chronic symptoms that negatively impact daily functioning and quality of life. Symptoms of AHP prevent many individuals from working and achieving lifetime work averages. The aim of this study was to apply a public economic framework to evaluate AHP in Belgium, taking into consideration a broad range of costs that are relevant to government in relation to social benefit payments and lifetime taxes paid.

Methodology

A public economic framework was developed exploring lifetime costs for government attributed to an individual with AHP in Belgium. Work-activity and lifetime direct taxes paid, indirect consumption taxes and requirements for public benefits were estimated based on established clinical pathways for AHP and compared to the general population (GP). The model includes AHP-related healthcare costs and non-AHP healthcare costs for the GP.

Results

Lifetime earnings are reduced in an individual with AHP by €347,802 per person (p.p.), translating to reduced lifetime taxes paid of €183,187 for an AHP individual compared to the GP. We estimate increased lifetime disability benefit support of €247,242 for an AHP individual compared to GP. Lifetime healthcare costs for a person with AHP were estimated to be €3,030,316 due to frequent hospitalisations associated with porphyria attacks compared to the GP. The lifetime costs for a person with 12 attacks per annum factoring in transfers, taxes and healthcare costs are estimated to be €3,460,745 p.p. Eliminating AHP attacks after 10 years of active disease, thus, enabling a person to return to work increases lifetime earnings by €224,575. Increased work activity in this cohort would generate an estimated €118,284 p.p. over their lifetime. The elimination of AHP
attacks could also lead to reductions in disability payments of €179,184 p.p. and healthcare cost savings of €1,511,027.

Conclusions

Due to severe disability resulting from constant attacks, AHP patients incur significant public costs. Lifetime taxes paid are reduced as these attacks occur during peak earning and working years. Reducing AHP attacks can confer significant fiscal benefits for government, including reduced healthcare costs, reduced disability payments and improved tax revenue.

Keywords: acute hepatic porphyria (AHP), disability, public economics, cost-analysis, taxation, public benefits, employment, fiscal analysis
Background

Acute hepatic porphyria (AHP) is a group of 4 ultra-rare, genetically distinct diseases that are characterised by episodes of neuro-visceral attacks, with occasional cutaneous manifestations [1]. The 4 diseases of AHP are acute intermittent porphyria (AIP), variagate porphyria (VP), hereditary coproporphyria (HCP), and hereditary deficit of delta-aminolevulinic acid dehydratase (ALA dehydratase-deficiency porphyria (ADP). AHP are disorders that result from a genetic defect leading to deficiency in one of the enzymes of the haeme precursors biosynthesis pathway in the liver [2, 3]. In acute porphyrias, the respective enzyme deficiencies predispose patients to a variety of triggering factors, which provoke the accumulation of the neurotoxin (aminolevulinic acid synthase (ALA and porphobilinogen PBG) [3]. Being neurotoxins, both ALA and PBG are harmful to nerve cells and are associated with the episodes of neuro-visceral attacks.

Various causes can trigger an episode including excess alcohol, certain drugs, such as anticonvulsants, oral contraceptives, sulfonamides, drugs that are cytochrome P450 inducers, rapid weight loss, acute illness and infection, stress, hormonal factors related to the luteal phase of the menstrual cycle as well as pregnancy and the postpartum period [3]. The common symptoms vary from one form of AHP to another, and can significantly impact a patient’s quality of life, with severe symptoms such as severe pain, respiratory failure, seizures, hallucinations, anxiety, weakness, fatigue, numbness, nausea and vomiting, lesions or blistering on sun-exposed skin [4]. The neurological manifestations of acute porphyrias can be life-threatening [3]. Patients presenting at hospital may have many symptoms related to dysfunction in the autonomic, central and peripheral nervous systems [5].

People with AHP experience a significant impairment of their health-related quality of life as they can suffer frequent and/or severe attacks [6] as well as experience chronic symptoms between attacks [7]. A natural history study was conducted in 112 AHP patients who experience recurrent
attacks, defined at 3 or more porphyria attacks within the 12 months prior to the start of the study. Sixty-five percent of the patients reported experiencing chronic symptoms, 20% experienced 6 to 10 attacks in the preceding 12 months, while as many as 32% reported having suffered more than 10 attacks in the preceding 12 months [5]. Furthermore, AHP is associated with serious long-term, health-limiting complications, including liver disease such as cirrhosis and cancer, chronic kidney disease and systemic arterial hypertension [5]. A patient-level data analysis of 88 patients observed that patients with recurrent porphyria attacks (n = 11) and those who were symptomatic (n = 24) experienced multiple chronic comorbidities. Of those rated as “recurrent cases”, 72.7%, 63.6% and 9.1% also had hypertension, chronic kidney disease and hepatocellular carcinoma, respectively [8].

The attacks and complications related to AHP can lead to absenteeism from work, or even an inability to work. In the natural history study by Gouya et al (2020), of those who were employed (part-time or full-time), 52% missed work due to their porphyria, with a mean of 40.2 day’s work missed, and at least 21% of the patients had received disability allowances because of their porphyria in the past 12 months [5]. In the cohort data analysis by Neeleman et al (2018), 63.6% and 33.3% were unemployed in the recurrent cases and symptomatic group, respectively [8].

Current evidence suggests that there is significant unmet need in the treatment of AHP which results in substantial burden to patients, absenteeism and loss of productivity, and the associated financial burden for the healthcare system. This study sought to apply a public economic framework taking into consideration a broad range of costs that are relevant to government in relation to transfer payments and taxes paid by people with AHP.

**Methods**
Analytic framework

A public economic model was developed to assess lifetime tax contributions and government payments received for disability, pensions and healthcare for a person with AHP compared to the GP. The analytic framework is similar to methodologies used by governments to assess the impact of policy changes on public accounts; and, in the present context, how different health conditions influence government accounts [9, 10]. The model was used to project the life course of people with AHP compared to the GP taking into consideration workforce participation, age-specific earnings and retirement at age 65. The model annually adjusts for age-specific disability in the GP and mortality in AHP and GP populations using published life tables for Belgium [11]. The model was developed to capture lifetime direct and indirect taxes and transfer payments from the government in each year of the model while adjusting for mortality.

Wages and taxes

Lifetime direct taxes were derived from age-specific annual earnings obtained from Statbel [12], and inflated based on the percentage increase in reported taxable income over the period of 2011 – 2017 [13]. Taxes were estimated by applying the age-specific gross earnings adjusted for the age-specific economic activity rate and multiplied by the tax wedge (the difference between before-tax and after-tax wages) to estimate annualised direct tax contributions and adjusting for mortality [12, 14, 15]. Indirect taxes were estimated by applying the 21% VAT rate to the proportion of age-specific disposable income to gross earnings [16]. The direct and indirect taxes combined represent the gross tax contributions (Table 1).

Disability status

Disability costs for being unable to work due to AHP were compared to background disability in the GP. The impairment imposed by AHP on work activity was adjusted according to severity of
AHP, where the unemployment rate has been reported as 63.6% and 33% for recurrent and symptomatic AHP, respectively [8]. In our analysis, we considered that 100% of those with recurrent AHP would be classified as disabled, and 50% of those with symptomatic AHP are unable to work. The age-specific disability rate in the GP was obtained from the European Union Statistics on Income and Living Conditions (EU-SILC) provided by Statistics Belgium and applied to work activity in the GP [16]. The average annual disability transfer payment obtained from household survey data was applied for every year of disability and adjusted for mortality using Belgium life tables [16, 17] (Table 1). All transfer payments were increased annually according to the rate of inflation in Belgium [18].

**AHP clinical scenarios**

Disease manifestation and progression are heterogenous in people with AHP, therefore limited data sets are available for defining a cohort on which to model. Clinical practice and validation of the associated costs was obtained from expert opinion and was validated with finding in the literature as part of establishing the healthcare resource use [19]. To reflect the heterogeneity of the disease, we developed three scenarios that defined disease progression to reflect fiscal costs to government based on likely clinical scenarios. For each scenario we estimated the likely fiscal consequences associated with the condition for a single individual, i.e., cohort n=1. In all cases, we considered that AHP symptom onset was aged 30 with an average of 12 attacks per year and an analytic time horizon set to age 100 and compared with a non-AHP individual.

- **Scenario 1**: AHP attacks throughout life and unable to work (AL-W)
- **Scenario 2**: AHP attacks for 10 years, stopping at age 40, unable to work due to chronic comorbidities attributed to AHP (A10-W)
- **Scenario 3**: AHP attacks for 10 years, stopping at age 40, able to return to work (A10+W).
Health costs

Health costs for people with AHP included three components: 1) AHP treatment management costs; 2) costs of treating AHP-attributable complications; 3) cost per hospitalized AHP attack.

Annual age-specific healthcare expenditure for non-AHP individuals in the GP (GP) adjusted for inflation have been included for comparison [20]. Costs were estimated on a micro-costing approach of multiplying resource use by the Belgian unit cost, and supported with costs obtained from the literature, and adjusted to 2020 costs. Hospitalization costs were calculated according to Belgian guidelines [21], taking into account an average daily cost per hospitalization, a daily lump sum for drugs, a per stay lump sum for clinical biology and a per stay lump sum for medical imaging. The cost per attack that was treated in hospital was calculated by feedback on resource use from the expert consultation process [19], with unit cost data extracted from the national web-based pricelists [22, 23].

<<Insert Table 2>>

Hemin treatment is associated with several serious (grade 3 or 4) adverse events. The cost for treating these adverse events is calculated as an additional cost during the hospitalization for an acute attack and considers only an extension of the hospitalization period by 3-5 days [19]. The details of costs per event are provided in the supplemental data, Table A.

The average annual AHP-related cost per co-morbidity or chronic disorder and AHP-related acute attacks were derived from the literature and adjusted to 2020 values where necessary (Supplemental Data, Table B). Disease management and supporting costs per year were calculated by multiplying the annual cost by the proportion of patients with comorbidities per annualised attack rate (AAR) state, taking into account the distribution of patients across the different AAR categories [8] as shown in Supplemental Data, Table C. The resulting annual costs
excluding social costs per category are: € 6,192 (asymptomatic), € 20,930 (symptomatic), € 34,252 (recurrent) and € 34,252 (severe).

*Analytic output*

For each scenario, the model estimates the amount of transfers received every year and over the lifetime, which include disability payments, pension costs and public health costs, in order to derive total transfers. The output estimates the societal costs from lost productivity applying the human capital approach. The model also estimates the amount of lifetime taxes paid in each scenario based on age-specific average earnings adjusted for mortality and applied to the Belgian tax wedge [14]. All costs have been discounted annually at 3% as per guidelines on cost-effectiveness analysis in Belgium [24].

*Results*

The model estimates the impact of AHP on government cash flow from taxes collected and costs associated with healthcare and disability support pensions. These are reflected graphically demonstrating how the per capita transactions change every year. The model starts at age 30 at the point of diagnosis and counts differences in taxes (positive) between AHP and GP person. Additionally, the model calculates government costs (negative) over time for different public programs (e.g., disability, healthcare, pensions) while adjusting for mortality using Belgian life tables. We present the figure for scenario 1 which demonstrates the impact of AHP attacks throughout life and unable to work (AL-W) in Figure 1, and the figures for scenarios 2 and 3 are provided in the Appendix.

<<Insert Figure 1>>
The dominant costs for government associated with AHP are due to healthcare spending on attacks and associated comorbidities. Those experiencing lifetime AHP attacks of 12 per year incur €3,100,534 in discounted healthcare expenses compared to €70,218 in the GP resulting in an additional €3,030,316 costs over the lifetime of the individual. When attacks are stopped after 10 years, the lifetime healthcare discounted costs are estimated to be €1,519,284 more compared to the GP. The lifetime taxes paid was lower in those unable to work due to AHP resulting in lost tax revenue of €183,187 for AL-W and A10-W compared to GP, and for those able to return to work without permanent disability, reductions in tax of €64,903 would be anticipated compared to GP.

Improved working years were assessed in AHP individuals (A10+W) that reduced AHP attacks. The improved work activity in this group generated lifetime earnings of €509,141 compared to those unable to work of €284,565. The improved work activity after reducing attacks can generate €509,141 in lifetime tax contributions compared to €251,535 in those people with AHP not able to return to work.

Discussion

Many chronic health conditions and acute medical events can lead to economic consequences that extend beyond health service costs. People with AHP suffer from impaired physical functioning and ongoing symptoms between attacks, of which chronic pain is the most notable and frequently observed, in addition to mood disorders and gastrointestinal symptoms [3]. Many people manage chronic pain with regular opioid use, thereby putting themselves at risk of opioid dependency [25]. Due to the symptoms associated with acute attacks and underlying comorbidities associated with AHP can lead to employment disruptions and in many cases cause people to withdraw from work entirely and influence quality of life. This not only influences the
earning capacity of individuals which can influence households but can also influence the amount of lifetime taxes paid and the need for social benefit support provided by governments. In our analysis we capture the fiscal consequences on government associated with AHP.

Treatment practices have traditionally focused on treating acute AHP attacks. Acute AHP attacks can be treated with prompt intravenous hemin (an iron-containing porphyrin) therapy to avoid the development of potentially irreversible neurologic effects. The goal of treatment in acute attacks is to reduce the activity of hepatic 5-aminolevulinic acid synthase 1. Other treatment approaches for AHP include carbohydrate loading and intravenous glucose which can be administered during an attack or sometimes between attacks (prophylactically). However, hemin is not currently approved for the prophylactic treatment of AHP [1], [3]. Additionally, patients may require symptomatic treatment of autonomic dysfunctions, sensorimotor neuropathy and encephalopathy, as well as exclusion of the causative factors and adequate nutrition and fluid therapy [26].

Recently new therapies have been launched that have been shown to influence the number of attacks [27]. The analysis described here illustrates how preventing AHP attacks and likely changing the life course of people with AHP can offer public economic benefits for government. As described here, preventing disability in one person with AHP can save government approximately €247,242 in projected disability payments.

There are several weaknesses of the modeling approach described here. Firstly, to reflect the heterogenous nature of AHP, a scenario-based modeling approach was applied compared to a cohort model that would rely on statistical norms for disease outcomes and disease progression. The different scenarios reflected in our analysis are based on different credible clinical manifestations observed in real life, but not necessarily based on a cohort of subjects. As such, there is no statistical variance on which to perform sensitivity analysis that would lead to any
meaningful statistical mean. In this regard, scenarios were used to reflect the range of plausible clinical expressions and how they impact work activity. Furthermore, due to limited information on AHP associated mortality, we applied the average life-expectancy to the AHP individuals. This may be an over-estimate of current life-expectancy. Early mortality in people with AHP would have an impact on government public accounts by reduced spending on healthcare and disability benefits. Additionally, the fiscal modeling framework does not include the option for liver transplantation which is common in people with AHP that can improve outcomes, however it would also increase medical costs with only limited influence on the likelihood of returning to work. Finally, one of the major cost drivers in the analysis relates to how AHP influences work force participation and whether people discontinue work or not. In two of our scenarios, we assumed that AHP would cause people to withdraw permanently from the work force and in the third scenario we assumed 10 years of employment inactivity. This may not reflect the actual employment trajectory of people with AHP, but, in this regard, our work reflects the likely benefits for government from preventing disease progression and keeping people in the work force.

Conclusion

The constant attacks associated with AHP designate this condition as a severe disability and cause significant public costs. As these attacks occur during peak earning and working years, work activity and lifetime taxes paid are reduced. Decreasing AHP attacks can present significant fiscal benefits for government, including reduced health costs, reduced disability payments and improved tax revenue.
Ethics Approval and Consent

This study did not involve any primary data collection and no patient level data is included in the analysis.

Consent for publication

Not applicable

Availability of data

The results described here are a modeling study comprised from secondary data sources. No primary data collection was performed in relation to this work. All supporting data used for constructing the model is available in the public domain and has been cited or has been provided directly in the manuscript.

Competing interests

There are no competing interests

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Author contributions

- MPC: model design, cost data identification, results interpretation, manuscript development, final approval of manuscript
- NK: model design, programming model, cost data identification, results interpretation, manuscript development, final approval of manuscript
• SV: health costs, data input review and analysis, results interpretation, presentation and manuscript development

• JP: study design, health survey, cost data review, results interpretation, manuscript writing

• DC: clinical inputs, scenario development, results interpretation, manuscript development

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## Tables and Figures

### Table 1. Disability payments made by the Belgian government

| Parameter                        | Input value | Source |
|----------------------------------|-------------|--------|
| Average annual retirement pension| €14,400     | [28]   |
| Average annual disability payment| €13,613     | [16]   |
| Average annual wage growth       | 1.3%        | [13]†  |
| Average annual cost inflation    | 0.62%       | [18]   |
| Average annual healthcare inflation| 2%         | [29]   |
| Tax wedge                        | 52.7%       | [14]   |
| Value added tax                  | 21%         | [30]   |

† Derived from net taxable income reported over period 2011 -2017

### Table 2. Average cost per AHP attack treated in hospital

| Resource                  | % receiving | Units used | Unit cost | Total cost | Source |
|---------------------------|-------------|------------|-----------|------------|--------|
| Opioids (morphine)        | 100%        | 18†        | €0.68     | €12.29     | [19]   |
| Hemin                     | 100%        | 4 ‡        | €592.10   | €2,368.39  | [19]   |
| Hemin side effects        | 100%        |            |           | €102.45    | Appendix 1, Table A |
| Albumin                   | 100%        | 4          | €29.63    | €118.52    | [19]   |
|                      |       |   |       |       |
|----------------------|-------|---|-------|-------|
| Hospital admission, ER | 100%  | 1 | €43.69| €43.69|
| Hospital admission, ICU | 20%   | 2 | €179.69| €69.08|
| Hospitalization days  | 100%  | 7 | €492.27| €3,440.42|
| Blood test            | 100%  | 1 | €26.00| €26.00|
| **Total**             |       |   |       | **€6,180.83**|

†, Example, morphine 5mg hourly as required for 36 hours; ‡ Normosang 3mg/kg once daily for 3 days.
Table 3: Government costs and lost tax revenue for three different AHP clinical scenarios (discounted at 3%)

|                          | GP       | Scenario 1 (AL-W) | Change (AL-W – GP) | Scenario 2 (A10-W) | Change (A10-W – GP) | Scenario 3 (A10+W) | Change (A10+W – GP) |
|--------------------------|----------|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Disability transfers     | €40,277  | €287,519          | €247,242           | €287,519           | €247,242           | €108,335           | €68,058            |
| Pension costs            | €83,110  | €83,110           | €0                 | €83,110            | €0                 | €83,110            | €0                 |
| Health costs             | €70,218  | €3,100,534        | €3,030,316         | €1,589,502         | €1,519,284         | €1,589,502         | €1,519,284         |
| Sum of government costs  | €193,605 | €3,471,163        | €3,277,558         | €1,960,131         | €1,766,526         | €1,780,947         | €1,587,342         |
| Lifetime earnings        | €632,367 | €284,565          | -€347,802          | €284,565           | -€347,802          | €509,141           | -€123,226          |
| Gross tax                | €434,722 | €251,535          | -€183,187          | €251,535           | -€183,187          | €369,819           | -€64,903           |
| Work years               | 25.24    | 11.36             | -13.88             | 11.36              | -13.88             | 20.88              | -4.36              |

AL-W, AHP attacks throughout life and unable to work

A10-W, AHP attacks for 10 years, stopping at age 40, unable to work due to chronic comorbidities attributed to AHP

A10+W, AHP attacks for 10 years, stopping at age 40, able to return to work
Figure 1  Impact of AHP on government transfers and taxes attributed to a person diagnosed at age 30 and experiencing 12 attacks per year over lifetime (discounted 3%)
Supplemental data

Table A  Costs for hemin-related adverse events

| Hemin-related AE                  | Incidence | Unit cost per event |
|-----------------------------------|-----------|---------------------|
| Pyrexia                           | 0.0462    | €739.92             |
| Phlebitis/ISP                     | 0.0462    | €739.92             |
| Catheter-related complications    | 0.0231    | €739.92             |
| Adverse drug reaction             | 0.0231    | €739.92             |
| Total                             |           | €102.45             |
### Table B. Costs associated with co-morbidities in AHP-related attacks

| Comorbidity               | Annual cost | Source               |
|---------------------------|-------------|----------------------|
| **Pain**                  |             |                      |
| Headaches                 | € 330       | [32]                 |
| Chest pain                | € 3,367     | [33]                 |
| Back pain                 | € 1,224     | [34, 35]             |
| Abdomen pain              | € 1,495     | [35]                 |
| Upper Extremities pain    | € 3,367     | [33]                 |
| Lower Extremities pain    | € 3,367     | [33]                 |
| Genitalia pain            | € 3,367     | [33]                 |
| **Neurological comorbidity** |          |                      |
| Paraesthesia              | € 3,367     | Assumed equal to extremities pain [33] |
| Motor weakness            | € 2,937     | Assumed equal to neuropathy [36] |
| Paralysis                 | € 106       | [37]                 |
| Urine incontinence        | € 676       | [38]                 |
| Advanced Neuropathy       | € 2,937     | Assumed equal to neuropathy [36] |
| **Psychiatric comorbidity** |         |                      |
| Anxiety                   | € 942       | [32]                 |
| Depression                | € 2,091     | [32]                 |
| Psychosis/Hallucinations  | € 3,975     | [32]                 |
| Insomnia                  | € 604       | [39]                 |
| Condition                          | Cost (€) | Note                                      |
|-----------------------------------|----------|-------------------------------------------|
| Suicidality                       | 2,091    | Assumed equal to depression [32]          |
| **Long-term conditions**          |          |                                           |
| Hypertension                      | 589      | [40]                                      |
| Chronic kidney disease            | 35,270   | [41]                                      |
| Hepatocellular carcinoma          | 14,908   | [42]                                      |
| Hyponatremia                      | 877      | Assumed equal to anaemia [43]             |
| Epilepsy                          | 2,995    | [32]                                      |
| Anaemia                           | 877      | [43]                                      |
| Opioid addiction                  | 1,784    | [44]                                      |
Table C. Proportion of patients with comorbidities or long-term complications per health state

| Pain                        | Proportion of patients (%) |
|-----------------------------|----------------------------|
|                             | Headaches                  | Chest pain                 | Back pain                 | Abdomen pain               | Upper extremities pain     | Lower extremities pain     | Genitalia pain            |
|                             | 36.4%                      | 9.1%                       | 45.5%                     | 90.9%                      | 36.4%                      | 45.5%                      | 0.0%                       |
| Pain                        | Proportion of patients (%) |
|                             |                             | Proportion of patients (%) |
|                             |                             | 36.4%                      | 9.1%                       | 45.5%                     | 90.9%                      | 36.4%                      | 45.5%                      | 0.0%                       |
|                             |                             | 29.2%                      | 4.2%                       | 33.3%                     | 79.2%                      | 25.0%                      | 8.3%                       |
|                             |                             | 13.2%                      | 1.9%                       | 7.5%                      | 28.3%                      | 3.8%                       | 0.0%                       |
| Neurological conditions     |                             |                             |                             |                           |                           |                           |                             |
|                             | Paraesthesia                | Motor weakness             | Paralysis                  | Urine incontinence        | Advanced neuropathy        |                             |                             |
|                             | 36.4%                      | 45.5%                      | 9.1%                       | 0.0%                      | 27.3%                      |                             |                             |
|                             | 36.4%                      | 45.5%                      | 9.1%                       | 0.0%                      | 27.3%                      |                             |                             |
|                             |                             | 8.3%                       | 20.8%                      | 4.2%                      | 20.8%                      | 0.0%                       |                             |
|                             |                             |                             |                             |                           |                           |                             |                             |
| Psychiatric disorders       |                             |                             |                             |                           |                           |                             |                             |
|                             | Anxiety                     | Depression                 | Psychosis/Hallucinations   | Insomnia                  | Suicidality                |                             |                             |
|                             | 45.5%                      | 36.4%                      | 36.4%                      | 27.3%                     | 18.2%                      |                             |                             |
|                             | 45.5%                      | 36.4%                      | 36.4%                      | 27.3%                     | 18.2%                      |                             |                             |
|                             |                             | 20.8%                      | 12.5%                      | 4.2%                      | 0.0%                       | 0.0%                       | 1.9%                       |
|                             |                             |                             |                             |                           |                           |                             |                             |
| Long-term conditions        |                             |                             |                             |                           |                           |                             |                             |
|                             | Hypertension                |                             |                             |                           |                           |                             |                             |
|                             | 72.7%                      |                             |                             |                           |                           |                             |                             |
|                             | 72.7%                      |                             |                             |                           |                           |                             |                             |
|                             |                             |                             |                             |                           |                           |                             |                             |
|                             |                             |                             |                             |                           |                           |                             |                             |
|                             |                             |                             |                             |                           |                           |                             |                             |
### Table

| Condition                      | Chronic kidney disease | Hepatocellular carcinoma | Hyponatremia | Epilepsy | Anaemia | Opioid addiction |
|-------------------------------|------------------------|--------------------------|--------------|----------|---------|------------------|
| AAR: Annualised attack rate   | 63.6%                  | 63.6%                    | 45.8%        | 13.2%    | 63.6%   | 63.3%            |

### Figure 2

Impact of AHP on government transfers and taxes attributed to a person diagnosed at age 30 and experiencing 12 attacks per year for 10 years and unable to work discounted 3%
Figure 3: Impact of AHP on government transfers and taxes attributed to a person diagnosed at age 30 and experiencing 12 attacks per year for 10 years and returning to work discounted 3% (Scenario 3)