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**Quantifying the economic value of earlier and enhanced management of Anorexia Nervosa for adults in England, Germany and Spain: improving the care pathway**

**Short title: Economic value of improved care pathways for Anorexia Nervosa**

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1 **Abstract:**

2 **Background**

3 Anorexia nervosa (AN) is a serious mental illness. One third of people develop  
4 severe, enduring, illness, adversely impacting quality of life with high health system  
5 costs. This study assessed the economic case for enhanced care for adults newly  
6 diagnosed with AN.

7 **Methods**

8 A five-state 312 month-cycle Markov model assessed the economic impact of four  
9 enhanced care pathways for adults newly diagnosed with AN in England, Germany  
10 and Spain. Enhancements were halving wait-times for any outpatient care, receiving  
11 specialist outpatient treatment post-referral, additional transitional support post-  
12 referral, and all enhancements combined. Care pathways, estimates of impact,  
13 resource use and costs were drawn from literature. Net monetary benefits (NMBs),  
14 impacts on health system costs and Disability Adjusted Life Years (DALYs) averted  
15 were estimated. Parameter uncertainty was addressed in multi-way sensitivity  
16 analyses. Costs are presented in 2020 purchasing power parity adjusted Euros.

17 **Results**

18 All four enhanced care pathways were superior to usual care, with the combined  
19 intervention scenario having the greatest NMBs of €248,575, €259,909 and  
20 €258,167 per adult in England, Germany and Spain respectively. This represented  
21 maximum NMB gains of 9.38% (€21,316), 4.3% (€10,722) and 4.66% (€11,491) in  
22 England, Germany and Spain compared to current care. Healthcare costs would  
23 reduce by more than 50%.

24 **Conclusions**

25 Early and effective treatment can change the trajectory of AN. Reducing the  
26 untreated duration of the disorder is crucial. There is a good economic case in  
27 different country contexts for measures to reduce waiting times between diagnosis  
28 and treatment and increase access to enhanced outpatient treatment.

29 **Key words:** Anorexia nervosa, net monetary benefits, healthcare costs, enhanced  
30 care pathways, economic modelling

31

32

33 **Introduction**

34

35 Anorexia nervosa (AN) is a serious mental illness [1] with typical onset in  
36 adolescence and a protracted course. Over one-third of people develop severe and  
37 enduring illness (SE-AN) [2-4]. Lifetime prevalence is estimated at 2-4% among  
38 women and 0.3% among men [5]. 153,058 Disability Adjusted Life Years (DALYs)  
39 were due to AN in the WHO European Region in 2019, 78% for women [6]. The long  
40 duration of illness means that 117,946 (77%) of DALYs are for people aged over 20.

41 Although incident rates for AN peak in early adolescence, they remain high for young  
42 women in particular; for example Swedish registry data indicate 149, 95 and 40 AN  
43 cases per 100,000 women aged 18-19, 20-23 and 24-30; for men these rates are  
44 3.3, 2.9 and 1.0 [7]. The COVID-19 pandemic exacerbated the challenge. Systematic  
45 reviews, surveys and record studies with evidence from England, France, Germany,  
46 Ireland, Netherlands, Spain and Sweden suggest increased hospitalisation and AN  
47 diagnosis during the pandemic [8-12]. Analysis of 9 million English primary care  
48 records reported an increase in eating disorder (ED) incidence in women aged 17-19  
49 (32%) and 20-24 (14%) between 2020 and 2022 [13].

50 AN can have profound consequences. Malnutrition contributes to a wide range of  
51 physical and psychological disabilities which can severely disrupt physical, cognitive,  
52 socio-emotional and educational development. Metabolically active organs, such as  
53 the brain, are particularly impacted, with acute AN having a bigger effect on brain  
54 structure than other mental health conditions. For example, a 6% reduction in size of  
55 brain cortex has been shown [14]. Numerous psychological features include  
56 problems in cognitive flexibility [15], memory [16] and social cognition [17]. A meta-

57 analysis estimated prevalence of suicidal intentional self-harm at 17% among people  
58 with AN [18], while all-cause mortality rates are the highest of any mental illness [19].

59 Specific personality traits and psychological comorbidities, such as mood and  
60 anxiety disorders, are common, contributing to adverse outcomes [20]. People with  
61 co-morbid depression are six-times more likely to remain unrecovered after 22 years  
62 compared to those without depression [2]. Enduring illness has been associated with  
63 cognitive, behavioural and neurobiological changes adversely impacting treatment  
64 outcomes [21-23].

65 Healthcare costs associated with AN are high; costs of failing to treat effectively and  
66 early are numerous [19, 24]. Average admission length in Europe is 106 days [25];  
67 readmissions may be even longer [26]. In the UK, AN inpatient admissions have  
68 increased annually over the last two decades [27]. Evidence on educational  
69 attainment is equivocal; longitudinal studies in Norway and Sweden find little impact  
70 of eating disorders [28, 29], but studies indicate AN can lead to reduced workforce  
71 participation, higher absenteeism/presenteeism and lower earnings when employed  
72 [30].

73 A systematic review reported AN was associated with reduced mobility compared to  
74 bulimia nervosa and healthy controls [31]. The illness also has considerable negative  
75 impact not only on patients' health and wellbeing, but also on their immediate  
76 environment, posing substantial challenges to primary caregivers and families [32].

77 Guidelines on management of AN are available internationally, for instance in  
78 England they recommend outpatient psychotherapy, which can lead to good  
79 outcomes, especially when accessed early [33]. However, despite adverse health

80 and economic consequences, evidence on the extent and quality of guideline  
81 implementation is limited. Challenges include availability of specialist treatment, as  
82 well as the lack of resources, including knowledge of ED in primary care, beds and  
83 trained therapists. Reviews, mainly of European studies, indicate average duration of  
84 untreated AN between 15 months and 2 years [22, 34], with long periods of time  
85 between disorder onset, diagnosis, assessment and commencement of treatment  
86 [22, 35]. Delays in accessing treatment may be partly due to individuals not seeking  
87 help, as it is often the concern of others, (e.g. parents) that brings them to treatment.  
88 Many people with AN therefore still receive no ED-specific treatment and/or  
89 experience delays in treatment, while some remain completely untreated [34, 36].

90 Even when treated, a large proportion of individuals with SE-AN fail to respond to  
91 outpatient treatment; 20-30% may require rescue treatment, such as inpatient or day  
92 patient care, of which, 30-40% require repeated readmissions [20, 37]. Earlier and  
93 easier access to specialist services can prevent a protracted course of illness and  
94 improve outcomes [38]. A new form of early intervention the First Episode Rapid  
95 Early Intervention for Eating Disorders (FREED) for young adults (aged 16-25) in  
96 England has been able to shorten some service-related delays, with potential for  
97 improving outcomes [39] and reducing costs [40].

98 There is some further limited economic evidence base on treatments for AN in  
99 adults; a recent systematic review [41] identified a German analysis where focal  
100 psychodynamic therapy and cognitive behavioural therapy (CBT) had better  
101 outcomes and lower costs than care as usual for women [42], while high calorie  
102 refeeding was associated with lower hospital costs in a US trial [43]. In a pre-post  
103 study in the Netherlands, CBT had higher costs per remission gained but it is unclear



104 whether this is cost effective [44]. Other than FREED, no other economic evaluations  
105 looking at the benefits of reduced wait times and/or earlier access to specialist care  
106 pathways were identified.

107 Given this context, this study is a follow-up to European Brain Council (EBC)  
108 initiatives to estimate the burden and costs associated with disorders of the brain in  
109 Europe in 2010, which found that people with ED incurred the highest proportion of  
110 direct healthcare costs (72%) [45]. In 2015 the EBC initiated the Value of Treatment  
111 (VOT) research framework to investigate unmet needs in healthcare and the  
112 increasing all-age burden of brain disorders (both neurological and mental). A  
113 second round (VOT2) on new therapeutic areas (AN, Autism Spectrum Disorder and  
114 Major Depressive Disorder) launched in 2019 and produced a review of care  
115 pathways for adults with AN [46]. These pathways might benefit from improvements  
116 to transition points into care, or between levels and stages of care. Potentially,  
117 improvements, including early access to treatment, availability of effective  
118 treatments, and support for transitions out of tertiary services, might also be cost-  
119 effective. The aim of this study therefore was to model different enhanced care  
120 pathway scenarios showing their potential health and economic impacts in England,  
121 Germany and Spain.

## 122 **Methods**

123

124 Health economic modelling studies are widely used to help determine the potential  
125 strength of investment in different options for better health and wellbeing [47].

126 Models bring together evidence on effectiveness, resource use and costs from  
127 multiple sources. One approach is Markov modelling. It can be used to model

128 uncertain processes over multiple time periods known as cycles and reflect  
129 circumstances, as for AN, where individual health outcomes can fluctuate [48].

130 A five-state Markov model was constructed to compare five potential care pathways  
131 for an adult with newly diagnosed AN in England, Germany and Spain. The model  
132 was developed using TreeAge Pro Healthcare 2023 [49] and runs over 312 weeks  
133 (six years) with each Markov cycle lasting one week, comparing typical wait times  
134 and then subsequent use of outpatient and inpatient eating disorder treatment after  
135 AN diagnosis.

136 Figure 1 provides an overview of model health states. Figure 2 provides a schematic  
137 for AN care. Potential changes to enhance transition points post-diagnosis on this  
138 care pathway to model were drawn from the EBC's previous review [46].

### 139 *Care Pathway Scenarios*

140 In our model individuals enter when initially diagnosed with AN. **Scenario 1**, the  
141 baseline scenario, is a current care pathway based on existing data on waiting times,  
142 hospitalisation rates, length of inpatient stays and rehospitalisation rates, as well as  
143 current best practice recommendations for AN treatment [25]. It assumes people with  
144 AN are monitored in primary care, with no waiting period prior to accessing primary  
145 care. After this watchful waiting period individuals may be treated in outpatient  
146 specialist ED services or non-specialist services. In line with current English National  
147 Institute for Health and Care Excellence (NICE) recommendations for adults, we  
148 assume specialist delivered care is either the Maudsley anorexia treatment for adults  
149 (MANTRA) or specialist supportive clinical management (SSCM) [33].

150 Treatment is assumed to last 20 weeks; the model assumes in each subsequent  
151 weekly cycle there are three possible states: recovery, remission or relapse requiring  
152 a period of hospitalisation within two years, with the possibility of a further period of  
153 rehospitalisation over an additional one-year period. This includes the possibility of  
154 immediate relapse, recognising the risk of immediate failure of initial treatment.

155 Four enhanced care pathways are considered. **Scenario 2** looks at potential impacts  
156 of halving mean waiting times for outpatient treatment. Reduced wait time may be  
157 associated with better outcomes. Early interventions may also improve outcomes,  
158 as seen for example in the adult Spanish ED population, especially for those with  
159 subthreshold ED [20]. As the initial rate of hospitalisation following treatment in  
160 specialist ED services is lower than for non-specialist treatment, **Scenario 3**  
161 examines the impact of providing specialist treatment for everyone following referral.  
162 **Scenario 4** includes additional transition support, such as a hypothetical carer-  
163 focused intervention for those receiving specialist ED care. This is assumed to  
164 further reduce the rate of relapse and hospitalisation for those receiving specialist  
165 ED care by 50% compared to receipt of specialist ED care alone. **Scenario 5**  
166 combines all three enhancements to the care pathway.

167 The primary outcome is disability adjusted life years (DALYs) averted. A disability  
168 weight of 0.224 [50] was assigned to all time spent in states waiting, or receiving  
169 treatment, for AN. This is conservative, as it assumes that no DALYS were averted  
170 during periods of treatment. Recovery and remission states were assumed to incur  
171 no disability. The maximum possible DALYs averted per individual would be 6 (or  
172 5.43 when discounted), if all time over the six-year period was spent AN free.

173 Mean costs associated with AN events in each cycle were computed. All costs are  
174 presented in 2020 purchasing power parity adjusted (PPP) Euros using values  
175 (including UK) from Eurostat [51]. Where necessary, raw costs were first adjusted to  
176 2020 prices using country-specific GDP deflators [52, 53]. An annual discount rate of  
177 3.5% was applied to outcomes and costs. The economic analysis was undertaken  
178 from a health and social care system perspective.

179 In addition to estimating expected costs and DALYs averted for each scenario, net  
180 monetary benefits (NMB) associated with each model scenario were calculated  
181 using a notional willingness to pay threshold of €50,000 per DALY averted. NMB  
182 allows for transparent comparison of multiple strategies, including variation of  
183 willingness to pay thresholds, and can be used to rank different care pathway  
184 scenarios. Sensitivity analyses were performed varying all key parameters to see  
185 what impact this had on care pathway scenario ranking and magnitude of economic  
186 benefits gained. A CHEERS (Consolidated Health Economic Evaluation Reporting  
187 Standards) checklist is included in the supplement [54].

## 188 **Model parameters**

189 Table 1 provides an overview of parameters used, including country-specific unit  
190 costs for health services, as well as distributional assumptions. Country-specific  
191 estimates of time-waiting before treatment were obtained. In England, average  
192 duration of waiting time from first primary visit to referral and then treatment in a  
193 mixed population was reported at 27 weeks for people aged 19 and over [55]. A later  
194 study for people aged 16-25 with an eating disorder, 52% of whom had AN, also  
195 reported a mean 27 weeks just for the period from referral to treatment [56]. In  
196 Germany, average duration of wait time between disorder onset and treatment for

197 AN is 12 months [57], while in Spain average waiting time from onset of AN to first  
198 contact with services is 13.05 months [58]. Adjusting these latter two wait times to  
199 reflect the wait time period between primary care referral and treatment in England,  
200 where 85% of total waiting time fell between onset and primary care referral, average  
201 waiting times in Germany and Spain would be 7.8 and 8.775 weeks respectively. Our  
202 base case scenario conservatively assumed a high proportion of people (70%) would  
203 be treated in specialist services in all three countries, in line with previous estimates  
204 for young adults [59, 60].

205 Likelihood of hospitalisation in all countries following non-specialist care was  
206 assumed to be 40%, compared with 17% for those who received specialist care,  
207 based on experience with SSM and MANTRA [61, 62]. The rate of rehospitalisation  
208 was conservatively assumed at 41.2% in all three countries based on longitudinal  
209 data of adults with AN in Spain [20]. The model assumes re-hospitalisation occurs  
210 within 12 months of discharge from initial hospitalisation, in line with previous  
211 analysis [37].

212 Length of inpatient stay was drawn from a recent review [25]. Country-specific values  
213 were calculated as a weighted average. As only one study was from Spain, all  
214 calculations also include two studies which drew on European populations. Average  
215 length of stay was 16 weeks for England, 13.42 weeks for Germany, and 10.71  
216 weeks for Spain. In Spain, shorter inpatient admission is usually followed by a  
217 lengthy day-hospital stay, this averaged at 15 weeks [20, 63, 64] and was included in  
218 the Spanish model.

## 219 **Results**

220 Tables 2, 3 and 4 show the costs of each of the five scenarios, DALYs averted and  
221 NMB in each country. The potential economic case is greatest for the Scenario 5  
222 strategy that both substantially reduces wait times for contact with outpatient  
223 services, as well as increasing access to enhanced specialist care. The potential  
224 maximum NMBs are €248,575, €259,909 and €258,167 respectively in England,  
225 Germany and Spain, with gains of 9.38%, 4.30% and 4.66% compared to current  
226 care pathways. Scenario 4 which adds further transitional support for people  
227 receiving outpatient specialist care has the second-most NMB in all countries.  
228 Scenario 2 where waiting times for treatment are halved is the third ranked scenario  
229 in England and Germany, while scenario 3 which ensures all people with AN receive  
230 specialist outpatient care is third ranked in Spain.

231 Figures 3 and 4 show total expected costs and expected total DALYs averted per  
232 person with AN for each care pathway scenario in each country. In Figure 3 costs  
233 are consistently highest in the baseline scenario 1 and consistently lower in each  
234 subsequent scenario. The reductions in expected care pathway treatment costs  
235 between Scenarios 1 and 5 in England, Germany and Spain are 54.65%, 57.86%  
236 and 56.46% respectively. Increased access to specialist services, and thus reduced  
237 risk of further hospitalisations, drives these cost reductions. Figure 4 indicates the  
238 key driver of increasing the number of DALYs averted in all countries is reducing  
239 length of time waiting for treatment. Gains are greatest in England due to longer  
240 base case wait times. In all cases DALYs averted are maximised in Scenario 5.

#### 241 *Sensitivity analyses*

242 One-way sensitivity analyses were conducted to look at how changes in model  
243 parameters impact on expected NMB and relative ranking of care pathway

244 scenarios. Key parameters were varied 20% above/below baseline values. The  
245 DALY disability weight for AN was varied between its 95% confidence intervals,  
246 while the disability weight for remission/recovery was varied between 0 and the lower  
247 95% confidence interval for living with AN (0.15). Scenario 2 already indicated the  
248 model is sensitive to duration of expected wait time prior to access to specialist  
249 outpatient services; the longer the wait time the greater the economic case for  
250 action, however all other parameters, including length of hospitalisation, specialist  
251 versus non-specialist outpatient care services and inpatient care costs have little  
252 impact on model results and ranking of scenario NMBs (See supplement). We also  
253 undertook probabilistic sensitivity analysis varying key parameters concurrently  
254 10,000 times. Again, this did not change scenario rankings or magnitude of NMBs  
255 (see supplement).

## 256 **Discussion**

257 This study aimed to estimate the value of investing in enhanced care pathways for  
258 management of AN for adults in England, Germany and Spain. The model  
259 demonstrates that an enhanced care pathway strategy combining measures to  
260 reduce waiting time for specialist care, as well as use of specialist rather than non-  
261 specialist outpatient ED services, supplemented by additional transitional support,  
262 such as carer-focused interventions, generates the highest levels of NMB. This  
263 reflects both lower health system costs and higher levels of DALYs averted.

264 These results are in line with research indicating early and effective treatment can  
265 change the trajectory of AN and prevent it from becoming protracted. A German  
266 randomised controlled trial of psychotherapy in outpatients with AN followed-up over  
267 5 years showed earlier treatment in the course of the illness achieved better long-

268 term outcomes [65]. Although a recent review indicated there are few economic  
269 analyses looking at treatment of AN in adults [41], there is some prior economic  
270 evidence for early intervention and reduced wait time for adults. A quasi-  
271 experimental evaluation of the FREED model of early intervention in England  
272 indicated the chance of reaching a healthy weight at 12-months follow-up was  
273 tripled, with no statistically significant difference in costs between FREED and care  
274 as usual groups [40]. Modelling analyses in Germany also indicate a positive  
275 economic case for expanding access to psychological treatment in adults [66].

276 While our modelling suggests a good economic case for enhancing care pathways,  
277 this raises significant policy, resource and implementation challenges. While the  
278 resource savings as a result of reduced inpatient stays are substantial, we have not  
279 made any assumptions about the approach used to reducing wait times; this will not  
280 be costless. Approaches could include regulatory measures, such as waiting time  
281 targets; for example, these exist in England, but need more substantial monitoring to  
282 be effective [67]. There also needs to be investment in measures to achieve greater  
283 awareness among primary care practitioners of the importance of early intervention  
284 and more rapid access to specialist support [68,69]. If wait times are to be cut, there  
285 also needs to be investment in supply-side measures to increase capacity in  
286 outpatient care. In Germany, for example, numbers of qualified psychotherapists and  
287 psychiatrists experienced in ED to provide outpatient treatment are insufficient, even  
288 though there are sufficient inpatient and day patient beds. Without commitment to  
289 upfront investment for more psychotherapists in Germany there may be pressures to  
290 instead rely more on existing, but more expensive, inpatient care. Thus, resource  
291 requirements and costs associated with scaling-up the workforce, as well as raising



292 awareness in primary care practitioners and enforcement of wait time targets need to  
293 be considered in future modelling analyses.

294 Reducing waiting times may also impact on the chance of developing SE-AN,  
295 especially in sub-threshold AN cases [20] and reduce mortality risk [4]. While  
296 greatest benefits are gained from increased access to specialist outpatient care, our  
297 model indicates any measures that increase access to appropriate non-specialist  
298 outpatient care are of benefit. Improved training and support may be of value for  
299 these broader outpatient services, given the likely time-lag in expanding access to  
300 more specialist services. This is recognised in England, where Health Education  
301 England has expanded training for outpatient teams and specialist groups in  
302 MANTRA and cognitive behavioural therapy for ED [70].

303 Inpatient stays are a large driver of costs in ED. Our model does not consider  
304 outpatient or home-treatment interventions that reduce hospitalisation. These have  
305 promise and may reduce costs, although more support may be needed from family  
306 carers [71, 72]. Evaluation in a large-scale trial in Germany is underway [73].

307 Interventions such as skills training for caregivers (Experienced Caregivers Helping  
308 Others, ECHO), as well as other online and transition supports that help sustain  
309 effects of outpatient treatments should also be prioritised, in addition to development  
310 of highly effective first-line treatments [74, 75]. Digital approaches that are highly  
311 accessible and scalable may also offer opportunities for improved outcomes and  
312 greater cost savings.

313 Our model indicates a substantial economic case for care pathway enhancement,  
314 yet our estimates of benefits are likely to be conservative, as we have not considered  
315 wider benefits, for instance reducing what can be substantial mental and physical

316 health impacts, as well as time out of work, to informal carers [76] of better AN  
317 treatment. There will be additional benefits if productivity losses related to lower  
318 rates of participation in employment by people with AN, as well as potentially  
319 reduced performance (presenteeism) while at work, can be reduced. These gains  
320 could be substantial. Health insurance claim data in Germany indicate employees  
321 with AN have an average of 73 days absenteeism in the year after diagnosis [77].

322 The model also does not directly capture potential reductions in mortality; a recent  
323 meta-analysis reported a mortality rate of 0.7% at seven-year follow up from  
324 observational data, with longer waiting times associated with higher mortality [4]. Our  
325 measure of outcome, DALYs averted, is though weighted to take account of years of  
326 life lost due to AN, as well as years of life lived with AN.

327 Another challenge is that when using the DALY, the same disability weight is applied  
328 to all time spent living with AN. Therefore, our model assumes that individuals  
329 continue to experience the same level of AN disease burden regardless of  
330 differences in complexity or disease severity. While we mitigated this limitation by  
331 varying the disability weight attached to AN between 95% confidence intervals  
332 reported in the Global Burden of Disease study [78], and also varying assumptions  
333 on disability weight during periods of remission and recovery, future research might  
334 look at measures of quality of life associated with AN as an alternative. However,  
335 evidence on differences in utility weights used in estimating quality of life based on  
336 severity and/or complexity remain limited [79].

337 In the English model our estimate of wait is based on data from a mixed eating  
338 disorder population [55]. Ideally future analyses should use AN specific wait times,  
339 as these are likely to be lower because of the severity of the condition. However,

340 another English study, where 52% of the study population had AN, also reported a  
341 27-week waiting time, conservatively only covering the period from referral, rather  
342 than first primary care visit [56].

343 We recognise our model provides a limited number of enhanced care pathway  
344 scenarios; future modelling work could consider additional further scenarios and  
345 population groups. For instance, although 78% of AN disease burden in Europe is in  
346 people aged over 20, the value of investing in enhanced care pathways for AN in  
347 adolescents also needs to be examined. Very low levels of transition from child and  
348 adolescent to adult ED services have been reported [80]; the majority of young  
349 adults might instead transition to generic services or be treated in primary care; both  
350 can lack appropriate training and skills [81]. Yet, long-term impacts of AN emerging in  
351 adolescence are profound. In a 30-year follow-up study they spent on average 10  
352 years coping with AN; nearly 40% had another psychiatric disorder such as  
353 depression further impacting on cost [82]. Emerging US evidence indicates  
354 childhood AN, which is increasing in prevalence, may be associated with even worse  
355 long-term outcomes [83].

356 We have not considered differences in the value of care pathways by gender of care  
357 recipient. Although overall economic costs are similar, German analysis indicates  
358 rates of contact with outpatient services are lower for men; potentially this could  
359 reflect barriers in service access [84]. In England and Germany, we have assumed  
360 all inpatient care requires a stay in hospital, but some treatment may be offered by  
361 day care or home-treatment teams, but evidence on their effectiveness is still limited.  
362 Our model also assumes that specialist care is accessed via primary care but in all  
363 countries some individuals will be referred from acute care settings. Moreover, while

364 primary care is the most common pathway in Germany, many adults access care via  
365 direct contact with specialists, including internal medicine, as well as psychiatry and  
366 psychotherapy [57]; care can also be provided exclusively on an inpatient basis [85].

367 Notwithstanding these limitations and future areas for research, our model suggests  
368 policy and practice guidelines should put an emphasis on enhanced care pathway  
369 measures to reduce wait times and enhance access to specialist care, as these have  
370 the potential both to improve outcomes and avert healthcare costs.

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### 384 **Conflicts of interest**

385 JT has received royalties from published books on eating disorders, and an  
386 honorarium for a lecture on eating disorders. BHD has received an author fee and

387 speaker fee related to eating disorders. FFA received a consultancy honorarium from  
388 Novo Nordisk. PG received during the last 5 years fees for presentations at  
389 congresses or participation in scientific boards from Biogen, Janssen, Lundbeck,  
390 Merk, Otsuka, Richter and Viartis. No other authors have any conflicts of interest to  
391 declare.

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777 **Table 1: Model parameters (all costs in 2020 PPP adjusted Euros)**

<b>Input Parameter</b>	<b>Deterministic Value</b>	<b>Distribution Source</b>	
<b>Waiting time</b>			
Mean time from help-seeking to treatment (mixed ED population) (England) (weeks)	27	Normal	[55, 56]
Mean time from help-seeking to treatment for anorexia nervosa (Germany) (weeks)	7.8	Normal	[57]
Mean time from help-seeking to treatment for anorexia nervosa (Spain) (weeks)	8.775	Normal	[58]
<b>DALY weights</b>			
Remission / recovery from eating disorder	0	Beta	[50]
Living with anorexia nervosa	0.224	Beta	[50]
<b>Health service unit costs (England)</b>			
Adult Specialist ED Services, Admitted Patient (per day)	€686.03	Gamma	[86]
Non-specialist outpatient care (per contact)	€198.56	Gamma	[86]
Adult Specialist ED Service, Outpatient care (per contact)	€277.74	Gamma	[86]
GP Consultation (per contact)	€42.80	Gamma	[87]
<b>Health service unit costs (Germany)</b>			

Adult Specialist ED Services, Admitted Patient (per day)	€388.77	Gamma	[88]
Non-specialist outpatient care (per contact)	€42.57	Gamma	[88]
Adult Specialist ED Service, Outpatient care (per contact)	€89.36	Gamma	[88]
GP Consultation (per contact)	€22.96	Gamma	[88]
<b>Health service unit costs (Spain)</b>			
Adult Specialist ED Services, Admitted Patient (per day)	€454.66	Gamma	[89]
Non-specialist outpatient care (per contact)	€75.13	Gamma	[89]
Adult Specialist ED Service, Outpatient care (per contact)	€121.54	Gamma	[90]
GP Consultation (per contact)	€26.11	Gamma	[89]
Specialist Day Care	€105.21	Gamma	[90]
<b>Length of hospital stay (weeks)</b>			
England: inpatient	16.00	Normal	[25]
Germany: inpatient	13.42	Normal	[25]
Spain: inpatient	10.71	Normal	[25]
Spain: day hospital following inpatient stay	15.00	Normal	[20, 63, 64]
<b>Other probabilities</b>			
Probability of being treated with specialist ED outpatient/daycare	0.7	Beta	[59, 60]



Probability of being treated with non-specialist ED outpatient/daycare	0.3	Beta	[59, 60]
Probability of hospitalisation following specialist ED treatment	0.17	Beta	[61, 62]
Probability of hospitalisation following non- specialist ED treatment	0.40	Beta	[61, 62]
Probability of rehospitalisation	0.412	Beta	[20]
Maximum length of time to rehospitalisation (weeks)	52	Normal	[37]
Discount rate (after 12 months)	0.035	Fixed	[91]

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781 **Table 2: Expected Costs, DALYs averted and Net Monetary Benefits for each**  
 782 **Anorexia Nervosa Care Pathway – England (€'s 2020 PPP adjusted)**

Costs (€s)	Current	Halving wait times	Specialist access for all	Additional transitional support	Combination
Primary Care Management	1,315	672	1,315	1,315	672
Non-Specialist Outpatient Care	1,217	1,229	0	1,217	0
Specialist Outpatient Care	3,972	4,013	5,675	3,972	5,732
Inpatient Care	25,240	21,220	17,953	16,085	7,991
<b>Total Cost</b>	<b>31,744</b>	<b>27,134</b>	<b>24,943</b>	<b>22,589</b>	<b>14,395</b>
<b>DALYs</b>					
<b>DALYs averted</b>	5.181	5.248	5.187	5.188	5.259
<b>Incremental DALYs averted versus current care pathway</b>		0.067	0.006	0.007	0.078
<b>Net Monetary Benefits (NMB) (€s)</b>	227,259	235,243	234,387	236,824	248,575
<b>NMB gain versus current care pathway (€s)</b>		7,984	7,128	9,565	21,316
<b>NMB gain versus current care pathway (%)</b>		3.51%	3.14%	4.21%	9.38%

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785 **Table 3: Expected Costs, DALYs averted and Net Monetary Benefits for each**  
 786 **Anorexia Nervosa Care Pathway – Germany (€'s 2020 PPP adjusted)**

Costs (€s)	Current	Halving wait times	Specialist access for all	Additional transitional support	Combination
Primary Care Management	335	82	335	335	82
Non-Specialist Outpatient Care	260	266	0	260	0
Specialist Outpatient Care	1,271	1,301	1,816	1,271	1,859
Inpatient Care	11,655	9,976	8,290	7,428	3,757
<b>Total Cost</b>	<b>13,521</b>	<b>11,625</b>	<b>10,441</b>	<b>9,294</b>	<b>5,698</b>
<b>DALYs averted</b>	5.254	5.302	5.259	5.261	5.312
<b>Incremental DALYs averted versus current care pathway</b>		0.048	0.005	0.007	0.058
<b>Net Monetary Benefits (NMB) (€s)</b>	249,187	253,489	252,533	253,748	259,909
<b>NMB gain versus current care pathway (€s)</b>		4,302	3,346	4,561	10,722
<b>NMB gain versus current care pathway (%)</b>		1.73%	1.34%	1.83%	4.30%

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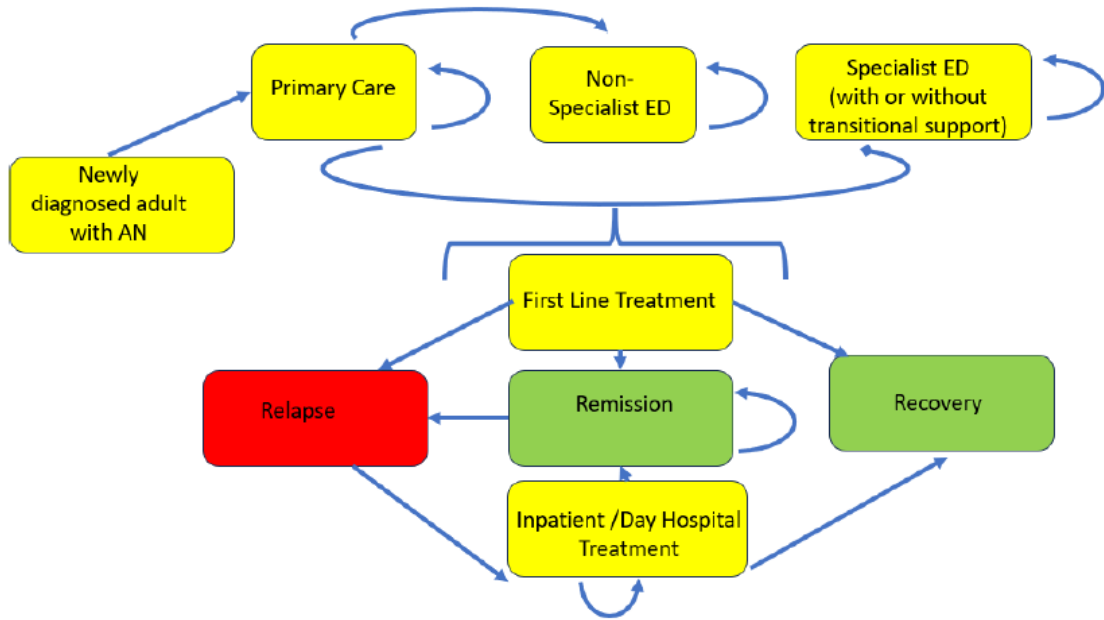
789 **Table 4: Expected Costs, DALYs averted and Net Monetary Benefits for each**  
 790 **Anorexia Nervosa Care Pathway – Spain (€'s 2020 PPP adjusted)**

Costs (€s)	Current	Halving wait times	Specialist access for all	Additional transitional support	Combination
Primary Care Management	256	104	256	256	104
Non-Specialist Outpatient Care	467	469	0	467	0
Specialist Outpatient Care	1,763	1,770	2,518	1,763	2,528
Day Hospital Care	1,871	1,879	1,331	1,433	707
Inpatient Care	11,969	10,011	8,514	7,636	3,770
<b>Total Cost</b>	<b>16,326</b>	<b>14,233</b>	<b>12,619</b>	<b>11,555</b>	<b>7,109</b>
DALYs averted	5.261	5.287	5.269	5.269	5.306
Incremental DALYs averted versus current care pathway		0.026	0.008	0.008	0.045
Net Monetary Benefits (NMB) (€s)	246,676	250,142	250,838	251,920	258,167
NMB gain versus current care pathway (€s)		3,466	4,162	5,244	11,491
NMB gain versus current care pathway (%)		1.41%	1.69%	2.13%	4.66%

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793 **Figure 1: State transition diagram**

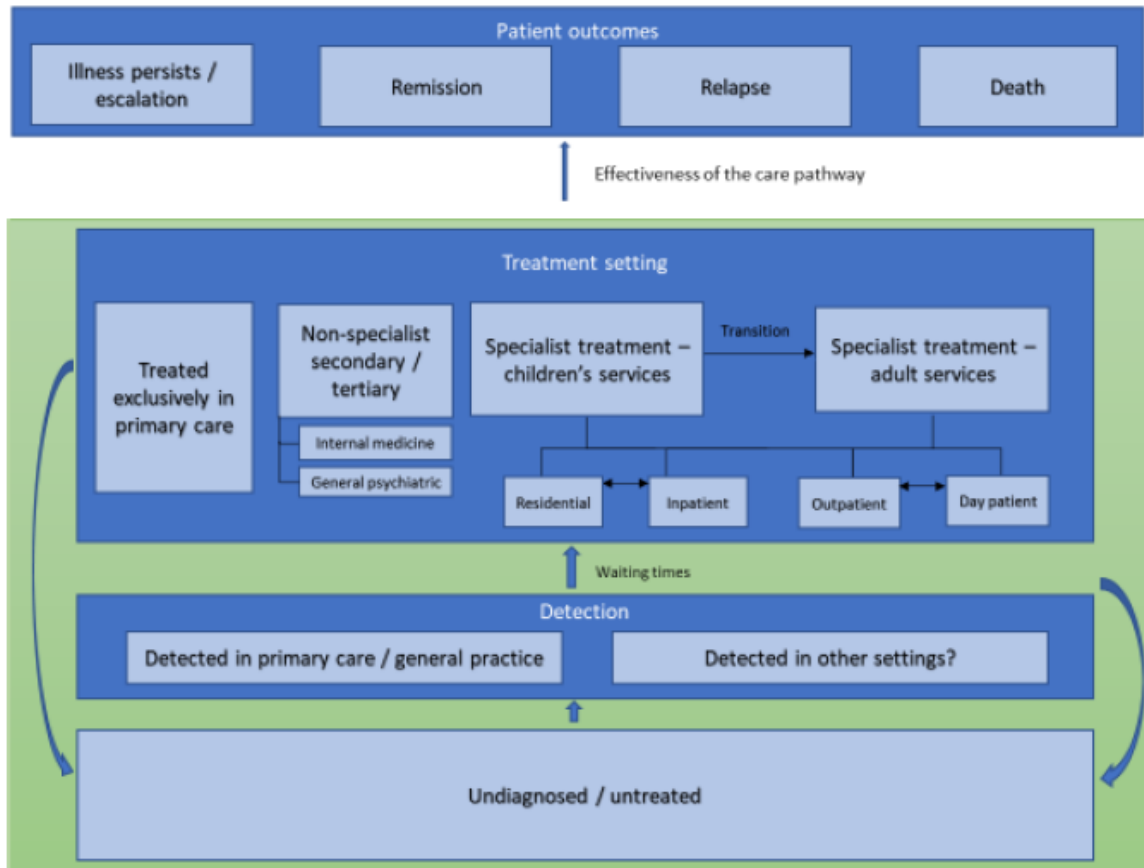


**Note:** A newly diagnosed individual may just receive one of the front-line treatments or a combination of treatments upon entry into the mode. The amount of time spent in remission before relapse can vary and includes the possibility of immediate relapse and immediate hospital treatment after the completion of outpatient treatment.

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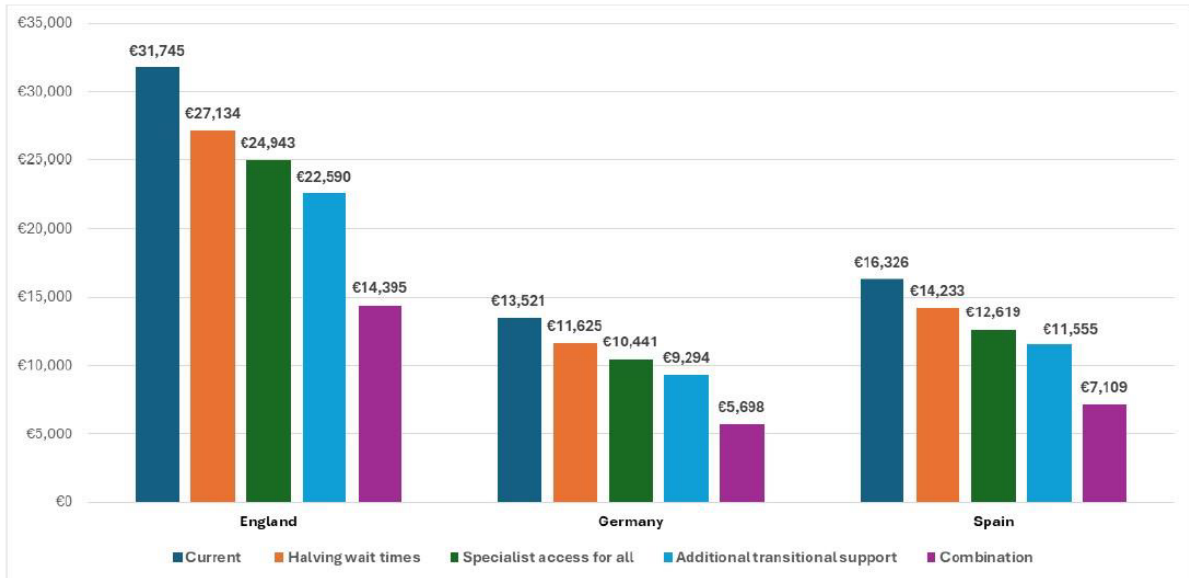
796 **Figure 2: Schematic care pathway for anorexia nervosa in Europe**



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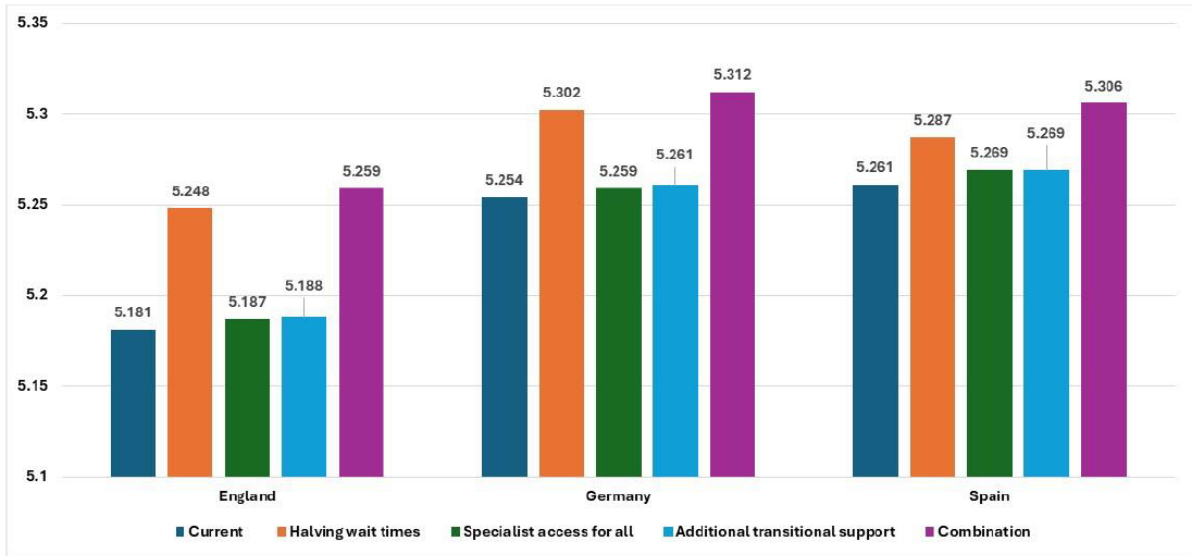
799 **Figure 3: Expected mean six year costs of anorexia nervosa care pathways per country and**  
800 **scenario (2020 PPP adjusted Euros)**



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803 **Figure 4: Expected mean disability adjusted life years (DALYs) averted of care pathways per**  
804 **country and scenario**



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