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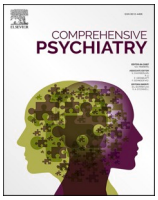

A cost-of-illness analysis of the economic burden of obsessive-compulsive disorder in the United Kingdom

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ABSTRACT

Objectives: Obsessive-compulsive disorder (OCD) is a chronic and debilitating psychiatric condition, with diagnosed patients typically experiencing moderate or severe symptoms. This study evaluated the cost-of-illness (CoI) of OCD in the UK, capturing the annual costs accrued to the National Health Service (NHS) and Personal Social Services (PSS), people with OCD, caregivers and society.

Methods: The UK OCD population was estimated and stratified by age group (children, adults, elderly), symptom severity (mild, moderate, severe) and treatment received (including no treatment). Costs for each subpopulation were estimated through a prevalence-based approach. Cost inputs were sourced from national databases, while additional inputs were informed by literature searches or expert clinician opinion. Scenario analyses explored other factors including comorbid depression treatment and presenteeism.

Results: The base-case analysis estimated a total annual CoI of £378,356,004 to the NHS, rising to £5,095,759,464 when a societal perspective was considered. The annual cost of care per person with OCD increased with severity (mild: £174; moderate: £365; severe: £902) due to increasing healthcare resource utilisation. The largest contributor to healthcare costs was cognitive behavioural therapy, while societal costs were driven by lost productivity through absenteeism. The base-case results likely underestimated the true economic burden of OCD; including comorbid depression led to a 132% increase in treatment costs, while presenteeism in people with OCD and lost productivity in caregivers amplified indirect costs.

Conclusions: The economic burden of OCD in the UK is substantial and extends beyond direct treatment costs, highlighting a need for research into alternative treatments with greater efficacy.

1. Introduction

Obsessive-compulsive disorder (OCD) is a chronic psychiatric condition characterised by a combination of recurrent obsessional thoughts and time-consuming compulsive rituals [1,2]. Amongst neuropsychiatric disorders, OCD has the tenth greatest disability burden globally [3], with studies reporting 12-month prevalence estimates of 0.7–3.0% in adults [4–8], and 0.25–0.30% in children [9,10].

OCD is often associated with both a clinical and humanistic burden. Symptom severity is typically measured using the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) in adults and the Children's Y-BOCS (CY-BOCS) for those below the age of 18. The Y-BOCS is a clinician-rated, 10-item scale that rates symptom severity from 0 (no symptoms) to 4 (extreme symptoms) [5,11]. Using these tools, moderate or severe symptoms are reported for the majority of diagnosed adults (mild: 3.7%; moderate: 65.6%; severe: 30.7%) and children (mild: 12.8%; moderate: 45.0%; severe: 42.8%) [5,12]. This translates into a significantly worse health-related quality of life (HRQoL) in patients with more severe symptoms (Y-BOCS score $\geq$ 20), with detrimental impacts on work status, relationships and wellbeing [5,13]. Common comorbidities including anxiety and mood disorders lead to further HRQoL decreases [5,14].

Current UK treatment guidelines for OCD follow a 'stepped-care' model, with stages reflecting increased levels of intervention (Fig. 1) [15]. First-line treatment typically consists of cognitive behavioural therapy (CBT) and/or pharmacological treatment with selective serotonin reuptake inhibitors (SSRIs) such as sertraline or fluoxetine. Beyond the first-line setting, clomipramine may be administered; alternatively,

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for severe, treatment-resistant OCD, inpatient care may be necessary [15].

The clinical and humanistic impact of OCD gives rise to a considerable economic burden, which can broadly be divided into direct and indirect costs [16]. Direct costs include treatment costs accrued to the healthcare provider, including those for the delivery of CBT, pharmacological therapy and inpatient treatment; expert clinician opinion suggests that these treatment costs may be amplified by comorbidities such as depression [16]. Direct costs also include medical costs accrued to patients through private therapy and miscellaneous out-of-pocket payments, such as increased travel expenditure and the purchase of cleaning items [16,17]. Meanwhile, indirect costs include lost productivity arising from absenteeism and presenteeism due to functional impairment, as well as work cutback for informal caregivers [18]. Studies also suggest correlation between morbidity with OCD and factors such as poorer educational outcomes and suicidality risk [19,20], which may have long-term economic ramifications.

Whilst the clinical and psychosocial burden associated with OCD has been well-documented, relatively little is known about its economic impact. A few health economic analyses have been published previously, however they are either outdated [21], focus on specific groups such as children and hospital inpatients [22,23], or aim to assess the relative cost-effectiveness of different treatment modalities [24–26].

A comprehensive cost-of-illness (CoI) analysis would allow quantification of the wide-ranging economic impact of OCD. As a similar proportion of the population is thought to be affected by OCD worldwide [27], the cost of OCD in the UK may provide a useful benchmark for the CoI in other economically developed countries, recognising however that treatment pathways and costs are likely to differ. By estimating the CoI to the healthcare provider, the results of this analysis could support healthcare decision-makers in the UK and comparable healthcare settings to facilitate efficient healthcare resource utilisation and care delivery. Moreover, by estimating the indirect CoI on additional stakeholders such as families and informal caregivers, this analysis could support the assessment of whether alternative funding strategies are needed to address the societal burden of the disease.

2. Material and methods

2.1. Model structure

A retrospective CoI analysis was performed to estimate the economic burden of OCD in the UK over a one-year time horizon, adopting a bottom-up approach. Firstly, the annual number of people with OCD in the UK was estimated based on prevalence data; secondly, this population was stratified based on age (children [5–17 years], adults [18–64 years] and elderly [≥65 years]), symptom severity (mild, moderate and severe symptoms) and treatment received (including the untreated population). Summation of the direct and indirect costs for each subpopulation allowed the calculation of the total CoI for the overall OCD population (Fig. 2).

Children and adults were considered separately as the stepped-care model recommends different treatment pathways for paediatric and adult populations, and societal costs based on lost productivity likely differ. Similarly, elderly people with OCD were disaggregated from adults due to differential employment status and hence lost productivity costs. Further subdivision of the population based on symptom severity (prior to treatment) reflected different therapy routes for individuals with mild, moderate and severe symptoms in the stepped-care model. Finally, subdivision by treatment type reflected the costs of different first-line and second-line therapy options available.

Following stratification, costs were captured over a one-year time horizon for each subpopulation from the following two perspectives: the healthcare provider (comprising the UK National Health Service [NHS] and Personal Social Services [PSS]) and the societal perspective (including people with OCD, their informal caregiver network and their employers). To estimate the treatment costs accrued to the healthcare provider, the interventions employed over the time horizon for each subpopulation were quantified and multiplied by the unit cost of each intervention. A similar approach was taken to quantify the overall costs to the individual (e.g. private therapy costs and out-of-pocket expenses) for each subpopulation. Indirect lost productivity costs were captured using a human capital approach, assuming that the value of earnings lost due to morbidity is equivalent to the value of the individual's contribution to society, for which the median gross full-time UK salary was used as a proxy [28].

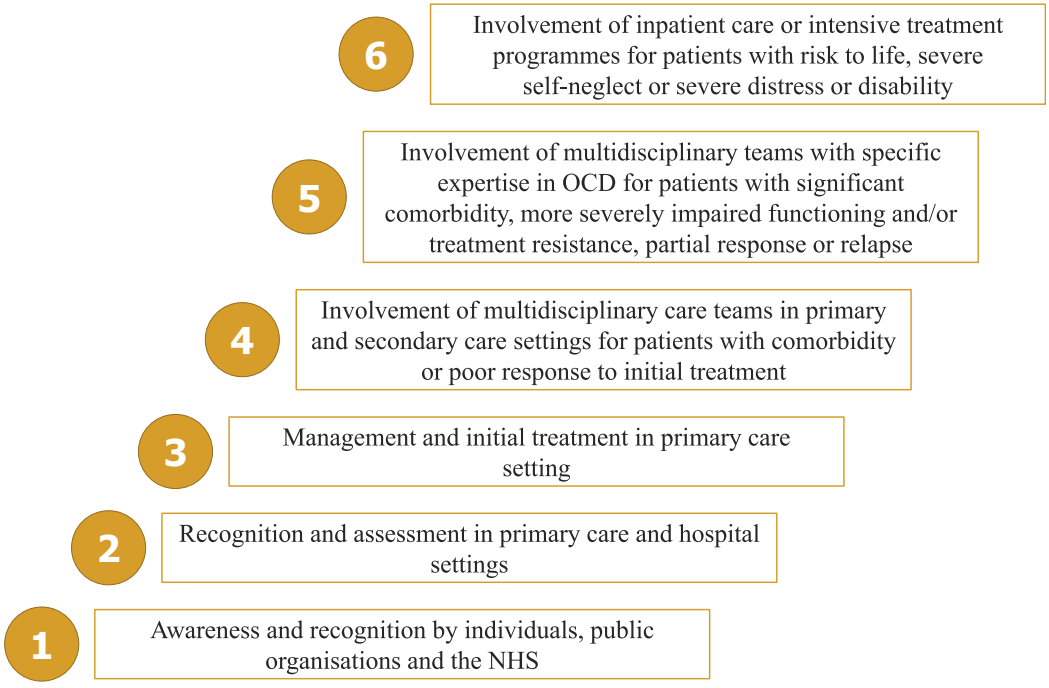

Fig. 1. Summary of the stepped-care model for OCD in the UK.
Abbreviations: NHS: National Health Service; OCD: obsessive-compulsive disorder.
Sources: NICE clinical guideline [CG31]: Obsessive-compulsive disorder and body dysmorphic disorder: treatment [15]; adapted from National Health Service South West London and St George's Mental Health NHS Trust [42].

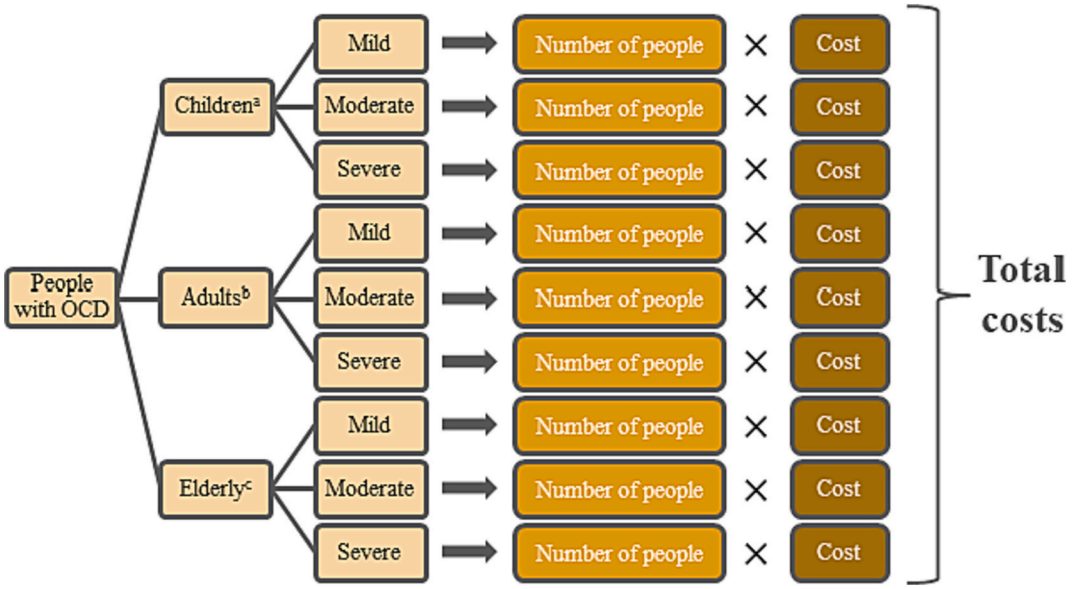

Fig. 2. Schematic of the CoI model structure.
Footnotes: Subdivisions by the 'Treatment' criterion have been excluded from this schematic. [a]Children: 5–17 years. [b]Adults: 18–64 years. [c]Elderly: ≥65 years.
Abbreviations: OCD: obsessive-compulsive disorder.

A conservative approach was taken in the primary analysis of the model, henceforth referred to as the base-case analysis. Only variables that could be modelled robustly (i.e. those for which relevant quantitative values could be identified from existing literature, or reasonably inferred or estimated from such literature and subsequently corroborated by expert clinician opinion) were included in the base-case analysis. Other variables were modelled as additional scenario analyses. The base-case analysis included the direct treatment and non-healthcare costs accrued by the healthcare provider and people with OCD, as well as lost productivity costs through absenteeism (for the adult subpopulation only). Following consultation with UK-based clinical experts experienced in the management of OCD, the impact of comorbid depression on OCD treatment costs was also considered; however, this was explored as a scenario analysis due to a paucity of data beyond the clinician estimates. Similarly, the impact of presenteeism and caregiver productivity losses were explored as scenario analyses due to limited available data. Costs associated with missed educational and employment opportunities and costs to informal caregivers beyond productivity losses were excluded, due to a high degree of uncertainty in the available data.

2.2. Model inputs

Model inputs included those related to disease epidemiology, treatment costs and indirect costs. Wherever possible, up-to-date and UK-specific input data for the model were sourced from the literature, with evidence gaps resolved through clinician consultation and further validated by a panel of three independent clinical experts.

Key epidemiological inputs utilised in the base-case analysis are presented in Table 1. General population-based characteristics were derived from Office for National Statistics (ONS) records, while disease-specific prevalence data were derived from recent national surveys (0.35% in children, 1.60% in adults and 0.30% in the elderly) [9,29]. OCD severity was determined by targeted searches of published literature, and validated by clinical opinion. Recent national survey data were reviewed and clinicians were consulted to determine the proportion of individuals accessing each type of treatment (Table 2), as well as the proportion of people with OCD who do not receive treatment from the healthcare provider (estimated to be 46%) [29]. Clinicians also estimated additional treatment requirements due to comorbid depression.

Table 1
Key epidemiological inputs.

Input	Value	Source
1-week prevalence of OCD		
Children	0.35%	MHYCP 2017 [9][a]
Adults	1.6%	APMS 2014 [29]
Elderly	0.3%	APMS 2014 [29]
Overall UK Population		
Children	10,408,860	ONS [40]
Adults	40,381,406	ONS [40]
Elderly	12,508,638	ONS [40]
Severity (% of OCD population)		
Children		
Mild	12.8%	Melin et al. (2018) [12]
Moderate	45.0%	Melin et al. (2018) [12]
Severe	42.2%	Melin et al. (2018) [12]
Adults		
Mild	3.7%	Ruscio et al. (2010) [5]
Moderate	65.6%	Ruscio et al. (2010) [5]
Severe	30.7%	Ruscio et al. (2010) [5]
Elderly		
Mild	3.7%	Jazi et al. (2020) [41][b]
Moderate	65.6%	Jazi et al. (2020) [41][b]
Severe	30.7%	Jazi et al. (2020) [41][b]

Abbreviations: APMS: Adult Psychiatric Morbidity Survey; MHYCP: Mental Health of Children and Young People in England survey; OCD: obsessive-compulsive disorder; ONS: Office for National Statistics; (C)Y-BOCS: (Children's) Yale-Brown Obsessive Compulsive Scale.
[a] Mean of the 1-week prevalence values for the 5–15 age group (0.30%) and the 5–19 age group (0.40%).
[b] Assumed to be the same as adult population.
Mild OCD in children defined as CY-BOCS score: 11–15; moderate OCD in children defined as CY-BOCS score: 16–25; severe OCD in children defined as CY-BOCS score: 26–40. Mild OCD in adults/elderly defined as Y-BOCS score: 11–20; moderate OCD in adults/elderly defined as Y–BOCS score: 21–30; severe OCD in adults/elderly defined as Y-BOCS score: 31–40.

Treatment cost inputs included in the model are presented in **Supplementary Table 1**. For each type of treatment (CBT, SSRIs, clomipramine and inpatient/residential care), unit healthcare resource costs were obtained using the publicly available PSS Resource Unit database (PSSRU) and the drugs and pharmaceutical electronic Market Information Tool (eMIT) [30]. The dosages for pharmaceutical interventions

Table 2
Treatment market shares for the overall OCD population.

Proportion of total OCD population receiving each treatment (%)[a]	Severity of OCD		
	Mild	Moderate	Severe
Children			
SSRI	0.00%	14.73%	2.46%
CBT	54.00%	29.46%	0.00%
SSRI+CBT	0.00%	9.82%	51.54%
Clomipramine	0.00%	0.00%	0.00%
Adults			
SSRI	37.43%	30.42%	0.00%
CBT	16.57%	9.57%	0.00%
SSRI+CBT	0.00%	14.00%	48.96%
Clomipramine	0.00%	0.00%	5.04%
Elderly[b]			
SSRI	37.43%	30.42%	0.00%
CBT	16.57%	9.57%	0.00%
SSRI+CBT	0.00%	14.00%	48.96%
Clomipramine	0.00%	0.00%	5.04%

Abbreviations: CBT: cognitive behavioural therapy; OCD: obsessive-compulsive disorder; SSRI: selective serotonin reuptake inhibitor.

[a] Estimates of the proportion of each OCD severity subpopulation receiving each treatment are based on the results of the 2014 Adult Psychiatric Morbidity Survey [29], adjusted for severity based on expert clinician opinion.

[b] Proportion of elderly patients receiving each treatment was assumed to be equal to that of the adult population.

were obtained from the relevant Summaries of Product Characteristics (SmPCs), while inputs related to inpatient and residential stays were collected directly from relevant specialist centres, supplemented by assumptions where necessary.

Indirect cost inputs were obtained from targeted literature searches. If UK-specific values were not reported, literature values for other countries were used if judged to be applicable to the UK population.

2.3. Model outputs

The base-case results of the model presented the annual CoI of OCD for subpopulations stratified by age, symptom severity and treatment status. Results were presented from the perspective of the healthcare provider, with the functionality to include the societal perspective.

To assess the robustness of the base-case findings, the model also explored the impact of varying certain parameters. Scenario analyses explored the impact of introducing additional cost categories, as well as alternative prevalence estimates, treatment market shares and choice of SSRI. Additional deterministic sensitivity analyses were also performed; these varied input parameters by ±10% to identify the most important drivers of the overall CoI of OCD.

3. Results

3.1. Key results

Key results of the base-case analysis are presented in Table 3. The total annual CoI of OCD in the UK was estimated to be £378,356,004 when solely considering the UK healthcare provider perspective. This translated to an annual cost of £525 per person with OCD, irrespective of whether and how they are treated. When the societal perspective was also considered, capturing lost productivity, out-of-pocket expenditure and private therapy costs in addition to treatment costs, the total annual CoI was estimated to be £5,095,759,464 (£7077 per average person with OCD, irrespective of whether and how they are treated). The societal cost far outweighed that borne by the healthcare provider, accounting for 92.3% of the total CoI.

3.2. Treatment costs

When the overall estimated OCD population was disaggregated by age, the annual cost to the healthcare provider was found to be greater for adults (£335,292,160) than for children and the elderly (£23,699,272 and £19,364,572, respectively), driven by the greater prevalence of OCD in adults. The average annual cost of care per person with OCD was slightly higher for children (£651) than for adults and the elderly (£519 and £516, respectively); children are more likely to be treated with CBT, which has a higher annual cost compared to other treatments.

The average annual cost of care per person was expectedly found to be higher for individuals with severe OCD (£902) than mild or moderate OCD (£174 and £365, respectively). This can be attributed in part to increased first-line healthcare resource utilisation by patients with severe OCD, but also to the existence of costly second-line inpatient and residential care for a subset of these patients. Overall, however, the annual costs to the healthcare provider for individuals with moderate and severe symptoms were found to be similar (£169,863,388 and £203,276,441, respectively), due to the higher prevalence of moderate OCD compared with severe OCD.

When considering treatment type, CBT was the greatest contributor to the annual cost to the healthcare provider (£325,360,492). Notably, the average annual cost per patient for treatment with SSRIs (£48) was much lower than that for treatment with CBT (£1417), despite both being recommended as first-line treatments for OCD (Fig. 3). As anticipated, the annual cost of treatment per patient for patients accessing inpatient care (£8658) was much higher than that for other treatments, given the considerable healthcare resource utilisation involved.

Table 3
Summary of the annual CoI of OCD in the UK.

Population	Total annual cost (UK healthcare provider)	Average annual cost per patient (UK healthcare provider)	Total annual cost (societal)	Average annual cost per patient (societal)	Total annual cost (overall)[a]	Average annual cost per patient (overall)[a]
Total OCD population	£378,356,004	£525	£4,717,403,460	£6551	£5,095,759,464	£7077
Disaggregated by age						
Children	£23,699,272	£651	£51,324,788	£1409	£75,024,060	£2059
Adults	£335,292,160	£519	£4,599,544,056	£7119	£4,934,836,216	£7638
Elderly	£19,364,572	£516	£66,534,616	£1773	£85,899,188	£2289
Disaggregated by OCD severity						
Mild	£5,216,175	£174	£170,002,070	£5675	£175,218,246	£5849
Moderate	£169,863,388	£365	£3,055,378,209	£6573	£3,225,241,597	£6938
Severe	£203,276,441	£902	£1,492,023,180	£6624	£1,695,299,621	£7526

Abbreviations: OCD: obsessive-compulsive disorder.

[a] Overall costs are the sum of the annual costs of OCD to the UK healthcare provider (comprising NHS and PSS costs) and societal costs associated with OCD.

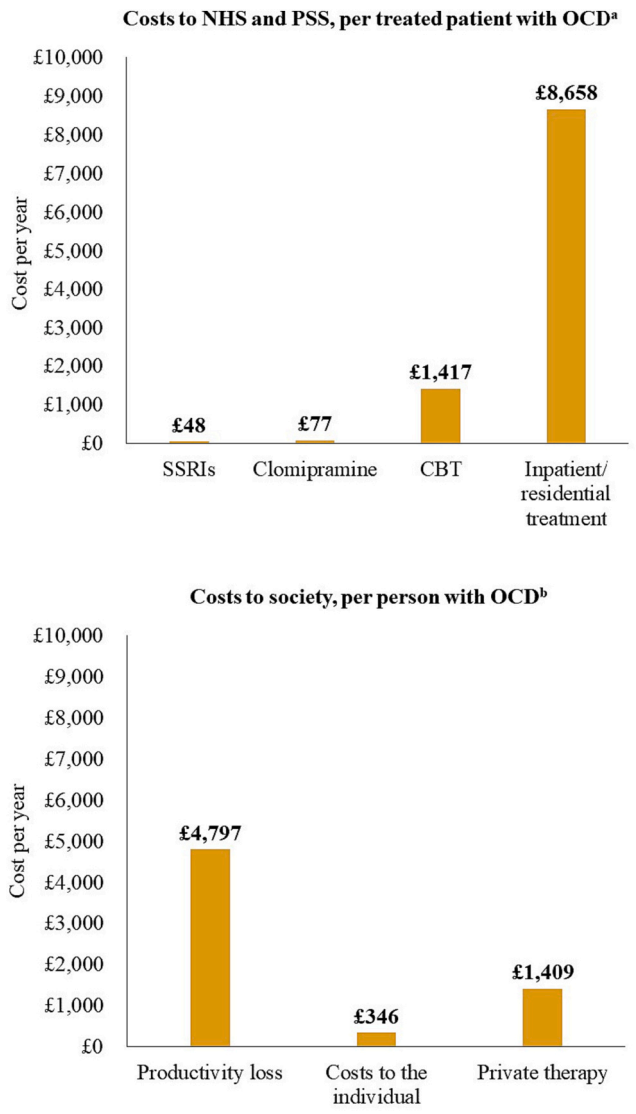

Fig. 3. Breakdown of annual costs per person arising from OCD.
Footnotes: [a]Costs per average patient (composite of all age groups and stratifications of OCD severity) that receives each respective treatment. [b]Costs to society per average patient (composite of all age groups and stratifications of OCD severity), irrespective of whether and how they are treated by the healthcare provider.
Abbreviations: CBT: cognitive behavioural therapy; NHS: National Health Service; OCD: obsessive-compulsive disorder; PSS: Personal Social Services; SSRI: selective serotonin reuptake inhibitor.

3.3. Societal costs

In the base-case analysis, a large proportion of the societal costs could be attributed to lost productivity due to work absenteeism amongst people with OCD (£3,453,984,177; £4797 per average person with OCD; Fig. 3). Lost productivity was only considered for adults; thus, the adult population was by far the greatest contributor to total costs when the societal perspective was considered (£4,934,836,216). The annual costs incurred from out-of-pocket expenditure (£248,984,142; £346 per average person) and accessing private therapy (£1,014,435,141; £1409 per average person; Fig. 3) were also considerable.

3.4. Scenario analyses

Altering the prevalence of OCD in children and adults had a major impact on the overall CoI, as the CoI of each age group in the model was proportional to the number of individuals with OCD in that age group. If the proportion of untreated individuals was increased, the CoI was found to decrease as a result of lower treatment costs. Similarly, if a greater proportion of people with severe OCD were inadequately treated, as suggested by alternative clinician opinion, the healthcare resource utilisation and treatment costs per person with OCD would decrease.

When additional treatment costs due to the presence of comorbid depression were included, there was a 132% increase in the overall CoI. The total annual cost to the UK healthcare provider increased from £378,356,004 to £877,970,647, while the average cost per person increased from £525 to £1219, driven by receiving additional CBT. In the scenario analyses including presenteeism amongst people with OCD and lost productivity amongst their informal caregivers, the total annual CoI increased to £10,706,746,489 (£14,869 per average person).

3.5. Sensitivity analysis

Tornado plots showing the deterministic sensitivity analysis results of the CoI analysis are presented in **Supplementary Fig. 1**. The prevalence of OCD in adults was found to be the most important driver for the cost of OCD to both the UK healthcare provider and to society. Variation in this parameter led to considerable variation in the final CoI results, as explored in the scenario analyses. The other key drivers of total CoI all stemmed from the inputs used to inform the societal cost, likely because a considerable majority of the total CoI of OCD was attributed to the societal cost.

4. Discussion

Our analysis revealed that OCD represents a substantial annual economic burden in the UK. According to the base-case results, the condition has an estimated annual cost of care of £378,356,004 (£525 per person with OCD) to the UK healthcare provider; the total CoI rises to £5,095,759,464 (£7077 per person with OCD) when a societal perspective is also considered.

There is a paucity of recent evidence with which to compare our results [31]. The annual cost of paediatric OCD in Sweden per child with OCD, including societal factors, was recently estimated to be more than twice that reported in our UK-based analysis [22]. The higher estimate may reflect the study's broader inclusion of all domains of healthcare resource costs associated with psychiatric disorders, and greater unit costs of psychological therapies. In contrast, the treatment-related costs of OCD per adult in China were estimated to be approximately three-fold greater than those reported by our analysis; this was predominantly driven by higher drug acquisition costs. However, the same analysis reported that the total cost, including societal considerations, was almost three-fold lower than our estimate, which may reflect the absence of private therapy costs from the analysis [23]. Comparisons with other mental health conditions in the UK suggest that our estimated total CoI for OCD is greater than that of anorexia (£2,454,000,000), while depression was found to incur the greatest total CoI of all mental health conditions (£26,286,000,000) [32]. Thus, whilst differences in healthcare systems and model characteristics result in differences in the estimated CoI, our results are of a similar magnitude to estimates reported for OCD in other economically developed countries and to other mental health conditions in the UK.

The base-case results of our analysis likely underestimate the true economic burden of OCD, as a conservative approach was taken. Whenever alternative inputs or costs were available, assumptions and values leading to the lowest overall contribution to the CoI were chosen. This approach is particularly relevant with respect to prevalence rates; using higher estimates in scenario analyses expectedly led to a considerably higher economic burden. Moreover, certain cost categories were excluded from the base-case analysis; inclusion of additional costs due to comorbid depression, presenteeism and lost caregiver productivity in

scenario analyses doubled the CoI. Other costs were excluded due to a paucity of available data, such as those arising from treatment-related adverse events and poorer caregiver HRQoL. Therefore, the true scale of the economic burden is likely to extend beyond the results presented.

A key finding of our analysis was the existence of a substantial treatment-related monetary burden borne by individuals with OCD, reflecting the costs arising from private therapy. Based on expert consultation, it was estimated that 30% of people with OCD access private therapy, in many cases supplementing treatment from the healthcare provider. Our findings yielded a total private therapy cost of £1,014,435,141 annually; this value is almost three times the cost of care borne by the healthcare provider and is equivalent to an additional £1409 per person per year. Costly private therapy therefore imposes a considerable economic burden on the individuals who access it, which suggests that the current stepped-care model is unable to support all patients effectively.

Our analysis also highlighted that a notable proportion of people diagnosed with OCD remain untreated; the base case of the model estimated that 46% of adults with OCD did not receive treatment based on data from the 2014 Adult Psychiatric Morbidity Survey and literature estimates indicate that this value may be as high as 60% [33]. These findings suggest further limitations in the stepped-care model at the treatment delivery stage. More follow-up from general practitioners and healthcare providers may be needed to ensure that treatment is accessible. Following consultation with expert clinicians, it was also considered that individuals with severe symptoms and functional impairment would be more likely to access treatment, as symptoms of the disease would present more clearly compared to mild and moderate OCD. Meanwhile, mild and moderate cases were more likely to be untreated, and there may therefore be a greater requirement for follow-up amongst these subpopulations.

A considerable number of individuals with OCD are also likely to be undiagnosed, and particularly high numbers of undiagnosed cases have been reported in settings such as dermatology outpatient clinics [34]. The relatively high proportions of individuals presenting with moderate or severe OCD may reflect an unwillingness to seek diagnosis amongst individuals with mild symptoms, or may alternatively reveal the lack of efficacy of currently available diagnostic tools such as questionnaires to capture cases towards the lower end of the Y-BOCS and CY-BOCS. Therefore, there may be a need to revisit the questionnaire-based tools currently used in practice and more reliable screening methods for the disorder may be needed to facilitate early intervention [35]. Due to the high comorbidity of other psychiatric disorders such as depression in people with OCD, more frequent screening of groups with these comorbidities could capture cases of OCD that might otherwise remain undiagnosed.

When considering treatment type, our analysis found that the average cost of treatment with SSRIs per patient was a fraction of the analogous cost of CBT treatment, due to differences in the mode of administration; SSRIs are typically self-administered, whereas CBT is delivered by a therapist (although, as noted below, SSRI treatment may also incur ancillary costs related to prescribing and dispensing, which were not included in the analysis). Both CBT and SSRIs are currently considered first-line treatments for OCD, according to the stepped-care model. From a decision-making perspective, health economic data on the costs of these two classes of intervention would be well-supplemented by data on their clinical efficacy, to allow an evaluation of their relative cost-effectiveness. Such analyses have been carried out previously in a randomised controlled feasibility study by Fineberg et al. and a network meta-analysis by Skapinakis et al., but with inconclusive and contrasting results [25,36]. There is a need for a definitive study comparing the efficacy of these two interventions, and also their combination (which is currently recommended for more severe cases) [25]. Future analyses could also compare costs and efficacies for different types of CBT, such as individual therapy, group-based therapy and telephone-based therapy; our current analysis was unable to distinguish between these modalities due to insufficient available data.

Our findings also demonstrate the extent of the humanistic burden of disease that accompanies the cost of treatment and management. The annual cost of lost productivity due to work absence amongst people with OCD was found to be £4797 per average person, and rose by 71.9% to £8246 when additional work cutback was considered through presenteeism. The chronic nature of the condition means that such costs are likely to be borne over an extended period, contributing to substantial lost income over a lifetime. Therefore, there may be a need for research into treatments that reduce the impairing symptoms and HRQoL decrement of the condition and ensuing lost productivity. Concordantly, scenario analyses exploring the impact of lost productivity amongst informal caregivers revealed a further substantial economic burden, contributing to the previously reported psychosocial and emotional burden experienced by these individuals [37,38]. Hence, there may be a need for decision-makers to revisit any support offered to this group.

Strengths of our analysis included the stratification of the OCD population; revealing groups that have particularly high unmet needs. We also attempted to quantify the associated indirect costs, for which there is a dearth of available evidence. Validation of model inputs by an independent panel ensured that the results reflected real-world conditions as closely as possible, while a conservative approach throughout the analysis allowed the base-case total CoI to be considered as a robust lower bound for the overall economic burden of disease.

Given that the prevalence of OCD appears to be similar globally [39], the prevalence-based conceptual framework applied in the present study to capture the costs to both the healthcare provider and to wider society could be readily adapted to countries with similar healthcare systems. Such analyses could quantify the financial burden associated with any unmet need for effective treatment, and guide broader cost-benefit analyses used in decision-making. Similarly, adaptation of the methods of stratification and the factors captured within this model could feasibly be applied to other mental health conditions with broadly similar care strategies and pathways.

A limitation of our model was the inability to capture the long-term effects of the condition. The model utilised a prevalence-based approach, exploring costs accruing due to the condition over a one-year time horizon. Application of an alternative incidence-based approach, involving estimation of the number of new cases of the condition per year and application of a lifetime cost estimate to these cases, could capture longer-term economic ramifications, such as missed opportunity costs arising from differential educational attainment. This incidence-based approach could form the basis of a future prospective observational cohort study to capture the lifetime costs associated with OCD.

Reflecting the conservative approach taken in the model, the costs accrued due to the provision of social care were not captured in our CoI analysis, since a robust and recent estimate of the proportion of individuals with OCD utilising these services, and the extent of their usage, could not be found within the literature. Similarly, whilst the impact of the condition on work productivity was considered, it was not possible to reliably estimate the proportion of individuals with OCD who receive disability allowance and thus this cost was not factored into our analyses. Doubtless, however, such costs exist and are borne by the PSS, by individuals living with OCD, and by wider society. Such considerations would be of great value to include in future analyses if supporting data become available.

In estimating the costs associated with the provision of SSRI treatments, due to a lack of robust available data and in line with our conservative approach, we did not include the additional costs of initial medical consultation, ongoing monitoring and dispensing. Therefore, the cost of SSRI treatment in our analyses must be considered to represent a lower bound for this value, due to exclusion of such cost categories. Furthermore, whilst our model estimated the CoI of OCD over a one-year time horizon, it was not possible to evaluate the interacting effects of direct and indirect costs, whereby the initial outlay of

healthcare resource provision, whether pharmacological, behavioural or residential, could be expected to have an effect on subsequent indirect costs. Nevertheless, owing to the conservative approach and estimates used throughout the model, our total OCD CoI estimate likely remains substantially lower than the true combined costs.

It may also be of interest to explore the impact of altering other aspects of the model methodology in future analyses. For example, our analysis assessed lost productivity through a human capital approach, utilising an individual's salary as a proxy for lost productivity costs. Subsequent analyses may alternatively use a friction-cost approach, which instead utilises the cost of replacement of an unwell individual as the financial proxy [16]. Future analyses may also use top-down and econometric approaches, rather than the subpopulation-based bottom-up approach taken in this analysis [16]. The findings of such subsequent investigations would further evaluate the economic impact of OCD, and may prompt discussion on preferred cost-of-illness methodology.

5. Conclusions

This analysis estimated an annual CoI for OCD of £378,356,004 (£525 per person with OCD) to the UK healthcare provider. When a societal perspective was also considered, such that lost productivity, out-of-pocket expenditure and private therapy costs were captured, the overall annual CoI rose to £5,095,759,464, with an average annual CoI of £7077 per person (irrespective of whether and how they are treated). Societal costs were found to considerably outweigh the treatment costs to the healthcare provider. The results of the analysis are likely to underestimate the true cost of OCD, as conservative prevalence estimates were used, and certain costs were excluded from the base-case analysis; inclusion of some of these costs in scenario analyses substantially increased the estimated CoI of OCD.

The analysis revealed a need for further research to identify more effective treatments to reduce the clinical and humanistic disease impact, especially in the domain of lost productivity. Given the suspected prevalence of undiagnosed OCD, the substantial proportion of diagnosed patients who do not receive treatment, and the commonality of people with OCD accessing private therapy, there is perhaps a need for decision-makers to revisit the existing screening and treatment delivery practices.

Future analyses could explore the economic burden prospectively, to capture the wide range of costs associated with the condition across the lifetime. In conjunction with the present study, such analyses could help to fully elucidate the economic burden to both the healthcare provider and the OCD population, to best inform decision-making pertaining to the provision of care.

Author contributions

Conceptualization: Kochar, Ip, Vardanega, Sireau, Fineberg.
Acquisition of data: Kochar, Ip, Vardanega, Sireau, Fineberg.
Analysis and interpretation of data: Kochar, Ip, Vardanega, Sireau, Fineberg.
Drafting of the manuscript: Kochar, Vardanega, Sireau, Fineberg.
Critical revision of the paper for important intellectual content: Kochar, Vardanega, Sireau, Fineberg.
Obtaining funding: N/A.
Administrative, technical, or logistic support: Kochar, Vardanega.
Supervision: N/A.
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Declaration of Competing Interest

Naman Kochar, Sophi Ip, Vittoria Vardanega: None.
Nick Sireau: Received grants or contracts from the Bally's Foundation, Saracens Foundation, Hospital Saturday Trust and the Big Lottery Fund; received consulting fees from Biohaven; received support for attending meetings of the World Orphan Drug Congress; has patents planned, issued or pending for a glutamate modulator for OCD; is a board member of Orchard OCD, Director of Sirgartan Therapeutics/Holdings, Director of Sireau Labs, Chair and CEO of the AKU Society and Chair of Beacon for Rare Diseases.
Naomi Fineberg: Received grants or contracts from COST Action, University of Hertfordshire and Orchard OCD; received payment or honoraria from Global Mental Health Academy; received support for attending meetings of the European College of Neuropsychopharmacology, British Association for Psychopharmacology, World Psychiatric Association and the Royal College of Psychiatrists; is a board member of Orchard OCD, secretary of the International College of Obsessive Compulsive Spectrum Disorders, chair of the European College of Neuropsychopharmacology Review Board and sits on the Expert Advisory Group for the Medicines and Healthcare products Regulatory Agency.

Data availability

All authors agree to make all data available at the editor's request for examination and re-analysis by referees or other persons designated by the editor.

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Appendix A. Supplementary material

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References

[1] National Institute for Health and Care Excellence. Guidelines for obsessive-compulsive disorder and body dysmorphic disorder: treatment. National Institute for Health and Care Excellence; 2005.
[2] World Health Organization. The ICD-10 classification of mental and Behavioural disorders clinical descriptions and diagnostic guidelines. World Health Organization; 1992.
[3] World Health Organization. The global burden of disease: 2004 update. World Health Organization; 2004.
[4] Kessler RC, Angermeyer M, Anthony JC, Graaf RDE, Demyttenaere K, Gasquet I, et al. Lifetime prevalence and age-of-onset distributions of mental disorders in the World Health Organization's world mental health survey initiative. World Psychiatry 2007;6:168–76.

[5] Ruscio AM, Stein DJ, Chiu WT, Kessler RC. The epidemiology of obsessive-compulsive disorder in the National Comorbidity Survey Replication. Mol Psychiatry 2010;15:53–63.
[6] Kessler RC, Chiu WT, Demler O, Merikangas KR, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. Arch Gen Psychiatry 2005;62:617–27.
[7] Adam Y, Meinlschmidt G, Gloster AT, Lieb R. Obsessive–compulsive disorder in the community: 12-month prevalence, comorbidity and impairment. Soc Psychiatry Psychiatr Epidemiol 2011;47:339–49.
[8] Cilliçilli AS, Telcioglu M, Aşkin R, Kaya N, Bodur S. Twelve-month prevalence of obsessive-compulsive disorder in Konya, Turkey. Compr Psychiat 2004;45:367–74.
[9] National Centre for Social Research. Mental health of children and young people in England, 2017. NHS Digital; 2017.
[10] Heyman I, Fombonne E, Simmons H, Ford T, Meltzer H. Prevalence of obsessive–compulsive disorder in the British nationwide survey of child mental health. Br J Psychiatry 2001;179:324–9.
[11] Goodman WK, Price LH, Rasmussen SA, Mazure C, Fleischmann RL, Hill CL, et al. The Yale-Brown obsessive compulsive scale: I. development, use, and reliability. Arch Gen Psychiatry 1989;46:1006–11.
[12] Melin K, Skarphedinsson G, Skärsäter I, Haugland BSM, Ivarsson T. A solid majority remit following evidence-based OCD treatments: a 3-year naturalistic outcome study in pediatric OCD. Eur Child Adolesc Psychiatry 2018;27:1373–81.
[13] Eisen JL, Mancebo MA, Pinto A, Coles ME, Pagano ME, Stout R, et al. Impact of obsessive-compulsive disorder on quality of life. Compr Psychiatry 2006;47:270–5.
[14] Heyman I, Mataix-Cols D, Fineberg N. A. Obsessive-compulsive disorder. BMJ. 2006;333:424–9.
[15] National Institute for Health and Care Excellence. Obsessive-compulsive disorder: Core interventions in the treatment of obsessive-compulsive disorder and body dysmorphic disorder. The British Psychological Society and The Royal College of Psychiatrists; 2006.
[16] Jo C. Cost-of-illness studies: concepts, scopes, and methods. Clin Mol Hepatol 2014; 20:327–37.
[17] Heslin M, Gellatly J, Pedley R, Knopp-Hoffer J, Hardy G, Arundel C, et al. Out of pocket expenses in obsessive compulsive disorder. J Ment Health 2020;607–12.
[18] El-slamon MAEA, Al-Moteri M, Plummer V, Alkarani AS, Ahmed MG. Coping strategies and burden dimensions of family caregivers for people diagnosed with obsessive-compulsive disorder. Healthcare. 2022;10:451.
[19] Pérez-Vigil A, Fernández de la Cruz L, Brander G, Isomura K, Jangmo A, Feldman I, et al. Association of obsessive-compulsive disorder with objective indicators of educational attainment: a nationwide register-based sibling control study. JAMA Psychiatry 2018;75:47–55.
[20] Albert U, De Ronchi D, Maina G, Pompili M. Suicide risk in obsessive-compulsive disorder and exploration of risk factors: a systematic review. Curr Neuropharmacol 2019;17:681–96.
[21] DuPont RL, Rice DP, Shiraki S, Rowland CR. Economic costs of obsessive-compulsive disorder. Med Interface 1995;8:102–9.
[22] Lenhard F, Aspvall K, Andersson E, Ahlen J, Serlachius E, Lavner M, et al. The cost of obsessive–compulsive disorder in Swedish youth. Child Psychiatry Hum Dev 2023;54:248–54.
[23] Yang W, Tang Z, Wang X, Ma X, Cheng Y, Wang B, et al. The cost of obsessive-compulsive disorder (OCD) in China: a multi-center cross-sectional survey based on hospitals. General Psychiat 2021;34:1–8.
[24] Gregory ST, Goodman WK, Kay B, Riemann B, Storch EA. Cost-effectiveness analysis of deep transcranial magnetic stimulation relative to evidence-based strategies for treatment-refractory obsessive-compulsive disorder. J Psychiatr Res 2022;146:50–4.
[25] Fineberg NA, Baldwin DS, Drummond LM, Wyatt S, Hanson J, Gopi S, et al. Optimal treatment for obsessive compulsive disorder: a randomized controlled feasibility study of the clinical-effectiveness and cost-effectiveness of cognitive-behavioural therapy, selective serotonin reuptake inhibitors and their combination in the management of obsessive compulsive disorder. Int Clin Psychopharmacol 2018;33:334–48.
[26] De Nadai AS, Quast T, Little TB, Westerberg K, Patyk KC, Monahan MF, et al. Intervention cost-effectiveness for pediatric anxiety and OCD: a systematic review and integrated database model. J Affect Disord 2022;298:110–8.
[27] Pallanti S. Transcultural observations of obsessive-compulsive disorder. Am J Psychiatry 2008;165:169–70.
[28] Office for National Statistics. Employee earnings in the UK: 2021. 2021.
[29] National Centre for Social Research. Adult Psychiatric Morbidity Survey: Survey of Mental Health and Wellbeing, England. NHS Digital; 2014. Last accessed: 18/01/2023.
[30] Personal Social Services Research Unit. Unit Costs of Health and Social Care. In: Curtis LA, Burns A, editors. Personal Social Services Research Unit; 2020.
[31] Knapp M, Henderson J, Patel A. In: Maj S, Okasha Zohar, editors. Costs of obesesive-compulsive disorder: a review; 2002. p. 253–99.
[32] McDaid D, Park A-L, Davidson G, John A, Knifton L, McDaid S, et al. The economic case for investing in the prevention of mental health conditions in the UK. Mental Health Foundation; 2022.
[33] Torres AR, Prince MJ, Bebbington PE, Bhugra D, Brugha TS, Farrell M, et al. Obsessive-compulsive disorder: prevalence, comorbidity, impact, and help-seeking in the British National Psychiatric Morbidity Survey of 2000. Am J Psychiatry 2006;163:1978–85.
[34] Fineberg NA, O'Doherty C, Rajagopal S, Reddy K, Banks A. How common is obsessive-compulsive disorder in a dermatology outpatient clinic? J Clin Psychiatry 2003;64:152–5.
[35] Fineberg NA, Hollander E, Pallanti S, Walitza S, Grünblatt E, Dell'Osso BM, et al. Clinical advances in obsessive-compulsive disorder: a position statement by the International College of Obsessive-Compulsive Spectrum Disorders. Int Clin Psychopharmacol 2020;35:173–93.
[36] Skapinakis P, Caldwell D, Hollingworth W, Bryden P, Fineberg N, Salkovskis P, et al. A systematic review of the clinical effectiveness and cost-effectiveness of pharmacological and psychological interventions for the management of obsessive–compulsive disorder in children/adolescents and adults. Health Technol Assess 2016;20:1–392.
[37] Ramos-Cerqueira AT, Torres AR, Torresan RC, Negreiros AP, Vitorino CN. Emotional burden in caregivers of patients with obsessive-compulsive disorder. Depress Anxiety 2008;25:1020–7.
[38] Vikas A, Avasthi A, Sharan P. Psychosocial impact of obsessive-compulsive disorder on patients and their caregivers: a comparative study with depressive disorder. Int J Soc Psychiatry 2011;57:45–56.
[39] Sasson Y, Zohar J, Chopra M, Lustig M, Iancu I. Epidemiology of obsessive-compulsive disorder: a world view. J Clin Psychiatry 1997;58:7–10.
[40] Office for National Statistics. Estimates of the population for the UK, England and Wales, Scotland and Northern Ireland. 2021.
[41] Jazi AN, Asghar-Ali AA. Obsessive-compulsive disorder in older adults: a comprehensive literature review. J Psychiatr Pract 2020;26:175–84.
[42] National Health Service South West London and St George's Mental Health NHS Trust. OCD: a guide for professionals; OCD: treatment approaches. NHS South West London St George's Mental Health NHS Trust 2022.