A break-even analysis of Starlight's Distraction and Boost Box services

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PRO BONO ECONOMICS

Pro Bono Economics uses economics to empower the social sector and to increase wellbeing across the UK. We combine project work for individual charities and social enterprises with policy research that can drive systemic change. Working with our volunteer economists, we have supported over 500 charities since our inception in 2009.

Starlight is the UK's leading charity for children's play in healthcare. They support children to experience the power of play to boost their wellbeing and resilience during treatment, care and recovery from illness.

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Executive summary

There has been a long-term upward trend in demand for children's services in NHS hospitals. Between 2007 and 2017, there was a 52% increase in outpatient visits for children under 14. Emergency admissions for under-18s totalled 560,000 in 2020/21, and more than half of those were children aged four and under.

Hospitals are struggling to cope with this demand, particularly in the aftermath of the Covid pandemic. The average paediatrics waiting time was 18.8 weeks as of November 2022, a 32% increase on the year before.

In these challenging circumstances, it is unsurprising that just four in every 10 children treated in hospital report that healthcare staff engaged them in play or distraction techniques. And yet, this may be a false economy; play in healthcare has been found to have a significant impact on the experience of treatment, while also reducing treatment times and costs for healthcare settings.

However, there are efforts underway to change this. The charity Starlight has a mission to deliver services that may improve mental, physical and emotional health, undertaking research and advocating for children to ensure their right to play is protected and provided for when they are ill in healthcare and recovery. Through their work, Starlight aims to help improve children's wellbeing during treatment and beyond, in turn providing efficiencies and cost savings to the NHS. They advocate for better access to play services in healthcare settings and promote the full recognition of health play practitioners as an integral component of the children's health workforce. Additionally, they fund health play specialists, and provide training, toys and activities to aid healthcare professionals in healthcare settings, who can in turn use these materials to improve a child's engagement with treatment and their overall hospital experience. The impact of their Distraction and Boost Boxes - each filled with bespoke and curated toys, games and puzzles for children to use in healthcare settings - are the main focus of this report.

This evaluation suggested Starlight's resources for play could deliver value for money for hospitals and allow for the reallocation of healthcare staff time:

- A sample of 105 healthcare professionals estimated that the use of Distraction and/or Boost Boxes could shave off six minutes of time for the average treatment.
- When scaled up to the estimated 987 health play practitioners using the two programmes in 2021/22, this would be equivalent to over 6,500 staff days 'freed up' for reallocation each year – this 'freed up' staff time could be valued at £2.2 million.
- Sedation could be avoided in as many as 100,000 treatments per year, the equivalent of a saving of up to £1 million per year across the two programmes.
- Just one-fifth of the savings estimated by healthcare professionals would need to be realised for the benefits of the programme to offset its costs.
- In other words, only two minutes needs to be 'freed up' per treatment, or reduced sedation achieved for just one in every 76 treatments, for the box programmes to break-even.

It is important to recognise that these estimates were based on recollections of a relatively limited sample of healthcare professionals and are subject to significant uncertainty.

Pro Bono Economics' analysis suggested that Starlight's work could reduce treatment times and need for sedation, and therefore generate net economic benefits to the NHS. To strengthen evidence of their Distraction and Boost Box services' impact in future, thereby allowing a more confident conclusion, it is advised that Starlight consider the following:

- Collect data on the number of healthcare professionals who use the services each year, rather than just those who order the boxes.
- Consistently use either 'number of treatments' or 'number of children' when estimating the charity's reach and impact through data collection.
- Record the total number of health play practitioners that are sent data collection surveys to understand what proportion answer them.

- To understand the value of staff time impacted by reduced treatment time, collect data on the pay band of the respondent.
- Collect data on the type of sedation that would be used/is used during treatments.

Introduction

In the past decade, the use of emergency hospital and outpatient care in England has increased, especially for infants.[1] A cohort study using data from the Clinical Practice Research Datalink suggests that, between 2007 and 2017, there was a 52% increase in the rate of outpatient visits for children under 14, a 23% increase in both emergency department visits and emergency admissions, and a 15% increase in elective admissions. For context, in 2020/21, at least 77,000 children were admitted to hospital due to injury.[2] There were 5 million A&E visits by children under 18. Children's admissions for long-term conditions, including asthma, diabetes, and epilepsy, totalled 24,000, and emergency admissions totalled 560,000.

On the healthcare delivery side, the NHS is experiencing long-term pressure on its resources. Doctors per head have fallen to three per 1,000 people in the UK, and nurses to eight per 1,000 people in the UK – this is below the average among OECD countries.[3] One in ten doctor and nurse posts are vacant in the UK – again these are worse than the OECD average for doctor and nurse staffing. Around four in five nurse vacancies and seven in eight doctor vacancies are filled by temporary staff. While agency staff can fill vacancies quickly, they are costly to the NHS, and use of them can disrupt NHS processes and hinder continuity of care.[4]

This rise in need, combined with increased pressure on resources (including the impact of the Covid pandemic), has resulted in an average paediatrics waiting time of 18.8 weeks, as of November 2022, an increase from 14.2 weeks in 2021. The growing backlog of people waiting for treatment, as well as NHS staff pressures, indicate that effective and efficient measures to alleviate these pressures are crucial.

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[1] Corresponding statistics refer to change time experiencing healthcare as measured by child-years; see: J Ruzangi, M Blair, E Cecil, G Greenfield, A Bottle, DS Hargreaves & S Saxena, Trends in healthcare use in children aged less than 15 years: a population-based cohort study in England from 2007 to 2017, BMJ Open 10(5), May 2020.

[2] Please see source for children's age ranges for which these statistics are reported: https://fingertips.phe.org.uk/profile/child-health-profiles/data#page/1/gid/1938133230/pat/159/par/K02000001/ati/15/are/E92000001/yrr/1/cid/4/tbm/1, accessed 25 April 2023.

[3] https://www.oecd.org/coronavirus/en/data-insights/number-of-medical-doctors-and-nurses, accessed 25 April 2023.

[4] L Rolewicz, B Palmer, C Lobont, The NHS workforce in numbers, Nuffield Trust, October 2022.

Being in hospital can be a distressing time for children, not only as a result of their condition, but also because the environment is unfamiliar and interaction with healthcare professionals can be stressful.[5] When hospital staff are overstretched, it may be even more distressing.
This may, at least in part, explain why children generally give less positive feedback about their care experience, compared to their parents. According to the Care Quality Commission (CQC), in 2020/21, children and young people gave mostly positive responses about how they were looked after and communicated with by healthcare professionals. However, less than half of children surveyed reported that they were involved "a lot" in decisions about their care, and one in three said they did not always understand what healthcare staff said to them. Children with a mental health condition, or those who were in hospital for medical (rather than surgical) treatment, gave less positive feedback on their experience.

Additionally, only 44% of children surveyed said there were enough things for them to do at hospital – a decrease from 50% in 2018 – which may also contribute to having a less positive experience. Overall, 41% said that healthcare staff did not engage them in play or other distraction activities. This is particularly important as there is evidence that play influences children's health, wellbeing and development.[6] Through a literature review and feedback received about their services, charity Starlight has found that play in healthcare can enable children and young people to have a more positive experience of hospital; reduce trauma, anxiety and distress linked to being in hospital; reduce a perception of pain during treatment, which will sometimes lead to a decrease in the need for sedation; help children and young people in hospitals build resilience; help to improve children and young people's engagement with treatment, which can lead to better recovery; and improve the rapport between the health professional, child and family.[7] The National Institute for Health and Care Excellence (NICE) even advises that therapeutic play and distraction techniques be included before, during and after healthcare treatments "to reduce boredom and anxiety".

[5] NICE, Babies, children and young people's experience of healthcare, NICE Guideline 204, August 2021.
[6] SL Nijhof et al., Healthy play, better coping: The importance of play for the development of children in health and disease, Neurosci Biobehav Rev. 95, December 2018.
[7] See primarily: S Gulyurtlu et al., The Impact of Children's Play in Hospital, October 2020.

With the CQC survey responses indicating that there is more to be done in providing adequate play and distraction to all children in hospitals, charities like Starlight have made this a priority. Starlight has a mission to deliver services that may improve mental, physical and emotional health, undertaking research and advocating for children to ensure their right to play is protected and provided for when they are ill in healthcare and recovery. They advocate for more and better health play services and promote the full recognition of health play practitioners as an integral component of the children's health workforce. They create and deliver a range of services and resources to children so they can experience and enjoy play. Healthcare professionals within hospitals and other healthcare settings apply directly to Starlight for resources; in the last year, Starlight has provided support to more than 600 healthcare settings.

Scope of this report

Pro Bono Economics (PBE) conducted a break-even analysis to explore the potential economic impact of Starlight's Distraction and Boost Boxes. Each of these boxes contain toys, games and puzzles for children to use in healthcare settings, with the aim of providing distraction and improving the healthcare experience for the child undergoing treatment. The results of this evaluation, summarised in this report, provided an initial view on whether Starlight's Distraction and Boost Boxes service offer value for money. PBE drew upon data that Starlight collected in 2022 that evidences who uses the boxes, what the impacts could be, what the boxes cost, and for how many treatments the boxes are used.[8]

The economic benefits measured were focused on the monetisable value of the healthcare staff time that is 'freed up' by using Distraction and Boost Boxes in treatments administered. It should be noted that these estimated benefits are not savings to the NHS, but rather an economic valuation of the 'freed up' time that staff can use to provide care and treatment for patients.[9] Additionally, the scope included estimating the saved cost of sedation, as health play practitioners report that they believe Starlight's

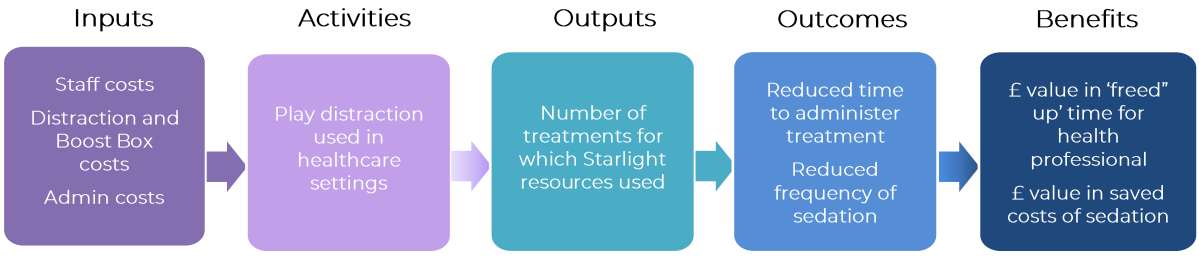
[8] The conclusions of this report only apply to the distraction and boost boxes services and not Starlight's other services of Starlight or of Starlight's work overall.

[9] For it to qualify as a saving then it would need to lead to a reduction in staff headcount or paid hours (and therefore a reduction in wages). This is unlikely to happen given the capacity constrained nature of many NHS services. However the value of the professional's time is a good indication of the potential benefits from being able to use that time to support another patient.

resources have avoided the need for sedation. The costs calculations in the analysis included the full cost of provision, including overheads, i.e. staff costs, costs of creating and distributing Distraction and Boost Boxes, and attributable admin costs.

Figure 1 outlines a logic model of Starlight's Distraction and Boost Box programmes.

Figure 1. Logic model illustrating how Starlight's Distraction and Boost Boxes could lead to economic costs and benefits



The approach

PBE conducted a break-even analysis of Starlight's Distraction and Boost Boxes to understand whether the services offer value for money. Analysis of data on estimated impacts collected from healthcare professionals allowed for an assessment of the minimum percentage of the estimated benefit that needs to be realised for the economic benefits to outweigh the costs.

The study used the following data Starlight collected in 2021/22:

- Collective Reach and Impact 2021-22 data - from a survey which received responses from583 healthcare professionals who administered treatment while making use of Starlight's resources, including the Distraction and Boost Boxes. This dataset contained estimates of the number of times the boxes have been used, and what percentage of respondents considered them to have avoided the need for sedation.
- Detailed Economic Impact Survey 2021-22 data - from a survey of 105 healthcare professionals who used Distraction and Boost Boxes in 2021-22. This included: their job title; their judgments on whether the boxes reduced need for sedation; their responses on how long they estimated the average treatment to take without Starlight's resources; their responses on how long they estimated the average treatment to take with Starlight's resources; and their estimates for the number of children they had treated in the last month who, due to Starlight's resources, had avoided sedation and experienced quicker treatment respectively.
- Orders List 2021-22 - this indicated the number of healthcare professionals who ordered the boxes that year.
- Financial Cost Data 2021-22this outlined Starlight's recorded direct and indirect costs for the boxes.

These datasets together allowed PBE to estimate the potential economic benefit of the Distraction and Boost Boxes in the form of the value of staff time 'freed up' and the avoided cost of sedation.

The evidence on potential savings was based on recollections of a limited number of healthcare workers and was subject to a high degree of

uncertainty. This paper's approach reflected these limitations by focusing on how much of the estimated cost savings needed to be realised for the benefits to outweigh the costs.

The research followed a seven-step methodology, outlined below, with further detail in Annexes A-E.

Step 1: Estimate economic costs of the services

PBE used Starlight's own financial cost data for Distraction and Boost Boxes in 2021-22 to estimate the total economic cost of the services. In addition, to estimate the average cost per treatment when a Distraction or Boost Box is used, this total was divided by Starlight's estimated number of treatments for which these boxes were used in the year.

Step 2: Estimate hourly wage of each healthcare staff member who has responded to their economic impact survey

In their Detailed Economic Impact Survey, Starlight collected responses from 105 healthcare professionals who used their Distraction and Boost Boxes in 2021-22. Each individual has recorded their job title. PBE matched each respective job title as accurately as possible against those in the Unit Cost of Health and Social Care dataset to estimate their hourly wage costs.[10]

Step 3: Estimate the time 'freed up' for each response in the survey

Each individual in the survey reported if use of Starlight resources led to a reduced treatment time. If it did, then they submitted estimates for:

- The number of children they saw per month for whom treatment time was reduced.[11]
- The average time they estimated that treatment would take without Starlight resources.
- The average time they estimated that treatment would take with Starlight resources.

[10] https://www.pssru.ac.uk/project-pages/unit-costs/, accessed 25 April 2023

[11] Note: due to evidence gaps, PBE approximates "number of children" to "number of accesses by children" due to different methods of data collection by Starlight – this is a weakness of any analysis using this data. See Annex C for more information.

PBE took the differences in estimated treatment times with and without Starlight resources to estimate the maximum average time impact reported by the surveyed professionals.[12]

Step 4: Estimate the monetisable benefit of time that has been 'freed up' due to the use of Starlight's resources

The hourly wage of each staff member was multiplied by their estimated time 'freed up' to understand the estimated monetary value of the time 'freed up' (for a successfully quicker treatment) for each professional. Multiplying this by the reported number of children impacted by a quicker treatment time per month for each respective professional, resulted in the monetary value of the time 'freed up' by each professional in a month. Aggregating this across the whole sample of 105 professionals allowed an estimation of the value of time 'freed up' for all shorter treatments in this sample in a month.

To understand the potential benefits across the whole cohort of treatments in 2021-22, PBE scaled up the maximum monetary value of time 'freed up' from this sample of 105 professionals to an estimated 987 professionals using the services across the whole year, based on the Orders List data.[13] The number of children impacted in the sample were also scaled up by the same factor to estimate the total number of treatments that are completed with less staff time, due to Starlight's Distraction and Boost Boxes, based on the Collective and Impact Reach data. This then allowed PBE to estimate the average value of time 'freed' per treatment.

Step 5: Estimate the monetisable benefit of savings from reduced use of sedation

PBE used an economic cost estimate for a dose of sedation of £10, following NICE research and Starlight's guidance.[14] This was then multiplied by the number of children reported in the survey sample to have avoided sedation in a month due to Starlight resources; this is the

[12] The data has been cleaned to address erroneous negative time saving responses, and to leave outlier responses out from the main results. This is to ensure that outlier responses do not skew the analysis. See Annexes C and D for more information.
[13] We used the number of professionals who ordered the boxes as proxy for the number of users; see Annex C for more detail
[14] See Appendix F: NICE, Sedation in under 19s: using sedation for diagnostic and therapeutic procedures, NICE Clinical Guidelines 112, December 2010

potential estimated sedation cost saving per month across the sample of 105 professionals. According to the Collective Reach and Impact data, only 31% of staff reported avoiding using sedation as an impact. PBE took 31% of the estimated 987 total staff who used the resources in a year to calculate the approximate number of staff in a year that avoided using sedation. The maximum estimated sedation cost saving per month per staff was multiplied by the approximated number of staff in a year that avoided using sedation, to estimate the maximum estimated sedation cost saving across the year. This again allowed PBE to calculate the approximate average sedation cost saving per treatment that uses Starlight resources.

Step 6: Estimate the total monetisable benefit across all Starlight healthcare staff users per year

The maximum estimated benefit arising from avoided use of sedation was added to that of reduced treatment time to estimate the total maximum economic benefit generated by the boxes per year.

Step 7: Carry out break-even analysis to illustrate the potential value for money of the Starlight programme

PBE divided the estimated total costs by the estimated maximum total benefits to understand what percentage of that maximum benefit needs to be realised for the benefits to outweigh the costs. In other words, this approach estimated the minimum impact that needs to be realised for the services to still deliver value for money and therefore evidence Starlight's impact. A summary of these calculations is presented in Figure 3 in the Results section of the report.

Key assumptions

- PBE made the assumption that the healthcare professional responses to average time 'freed up' due to Starlight resources, as well as avoided instances of sedation, and the number of children impacted by these effects, were accurate. However, there is room for human error, and therefore the actual economic benefits could be higher or lower than calculated. This is the main reasoning for carrying out a break-even analysis, rather than a cost-benefit

analysis, as this approach is more appropriate in situations with a high degree of uncertainty.[15]

- It was assumed that Starlight's estimation of financial costs for the Distraction and Boost Boxes, in particular the estimated attributable indirect costs, were accurate. However, it is possible that actual costs may have differed, particularly if there were intangible costs that were not accounted for (e.g. the cost to the hospital of implementing these resources). Therefore, in reality, there could have been some deviation in the estimated cost and the actual cost; scenario analysis was conducted to explore the impact of this assumption.
- When estimating the average sedation and time 'freed up' impacts across treatments using Starlight's sample, PBE assumed that the respondents were representative of all of Starlight's healthcare professional service users. In actuality, there is a chance that the people who chose to respond to the surveys were the only ones experiencing the time 'freed up' and avoided sedation impacts. Therefore, by extending the reported impacts from the sample out to all staff, the main results may have overestimated the actual economic benefit.
- PBE made assumptions to estimate the hourly staff cost for each healthcare professional respondent. Care was taken to closely match the job title of each individual to a job title on the Unit Cost of Social Care and Health database, but in some instances a precise match was more difficult. For certain recorded job titles that were difficult to match, PBE applied the lowest value estimates to be conservative in the estimated benefits of the value of 'freed up' staff time.
- It was assumed that the number of treatments that used Starlight Distraction and Boost Boxes was roughly similar to the number of children who used these services. This is because Starlight had estimates on the number of treatments that these services had

[15] Cost benefit analysis provides a definitive figure for the £ benefits for each £ spent. Even where a wide range is provided around the answer it can convey a reasonably high degree of certainty in the evidence. A break-even analysis is more appropriate in situations of uncertainty as it identifies the minimum saving that needs to occur in order to offset the costs, leaving expert decision makers to judge whether they believe this is realistic or not.

been used for. However, Starlight's Detailed Economic Impact Survey of healthcare professionals included questions relating to the number of children impacted by reduced treatment time or who avoided sedation due to the boxes. This uncertainty was a contributing reason for PBE conducting a break-even analysis in this project, rather than a cost-benefit analysis.

- Starlight's best estimate for the number of healthcare professional service users was the number of those who placed orders for Distraction and/or Boost Boxes directly. While PBE used this as the estimate for the number of healthcare professionals using the services in the analysis, this and the resulting results driven by it might have been inaccurate because:
    - Some professionals may have ordered in 2020-21 to use in 2021-22 (similarly some may have ordered in 2021-22 to use in 2022-23)
    - Some may have ordered on behalf of their team of healthcare professionals. Starlight have said their research suggested this is sometimes the case
- Therefore, the actual number of healthcare professionals using the service might be higher, and therefore the estimated benefits might be lower than the realised benefits.
- PBE has assumed that each reported instance of sedation avoided would mean that nitrous oxide (or another similar-value medication) would have been administered otherwise. NICE's estimate for the cost of a dose of nitrous oxide was used in the calculations for each treatment where sedation is reported avoided as a result of Starlight's boxes. However, this may have been an overestimate; Starlight advise that their qualitative research suggests that the avoided sedation is reported to be low-medium intensity sedatives. While this includes nitrous oxide, it does also include other medicines. PBE used the estimate for a dose cost of nitrous oxide, given the available cost evidence, and applied this to the calculations. This cost may be greater than those of other sedatives administered, in which case the benefits may have been overestimated. The impact of this assumption was tested using scenario analysis.

- It was assumed that there was no overlap in the use Distraction and Boost Boxes, i.e., each recorded access to a Boost Box does not involve access to a Distraction Box, and vice versa. In reality, Starlight advise that a child may benefit from both boxes in one treatment, but that their research suggests this is uncommon. This matters when estimating the benefits per box; the more that both resources are used in one treatment among the sampled professionals, the more the benefits estimated from their responses are likely to exaggerate the actual benefit of one box.

Despite these limitations, PBE believes its approach provided a useful early indication of the potential value for money of Starlight's Distraction and Boost Box programmes. Scenario analysis was carried out to explore the impact of these assumptions on the key conclusions, and therefore understand how robust they are. Additionally, by analysing the mix of professions in the Detailed Economic Impact Survey and that of the Orders List, PBE found that they were not too dissimilar. This added confidence to the assumption that the sample of 105 in the Detailed Economic Impact Survey are representative of the wider health play practitioner group. Ultimately, PBE believes that this research has provided a foundation for further data collection that can increase confidence in the findings over time.

Results of our analysis

PBE's analysis of responses from 105 healthcare professionals suggested that the use of Distraction and/or Boost Boxes could lead to quicker treatment time for every one in three treatments. PBE estimated the boxes could shave off six minutes of time for the average treatment.[16] The benefits arising from 'freed up' staff time could therefore be £1.52 per treatment. Across the year, it is estimated that over 500,000 treatments could be quicker due to the use of Distraction and Boost Boxes; this is the equivalent of over 6,500 staff days made available to be reallocated to other healthcare demands. This impact could produce economic benefits of £2.2 million in the form of the value of staff time 'freed up'.

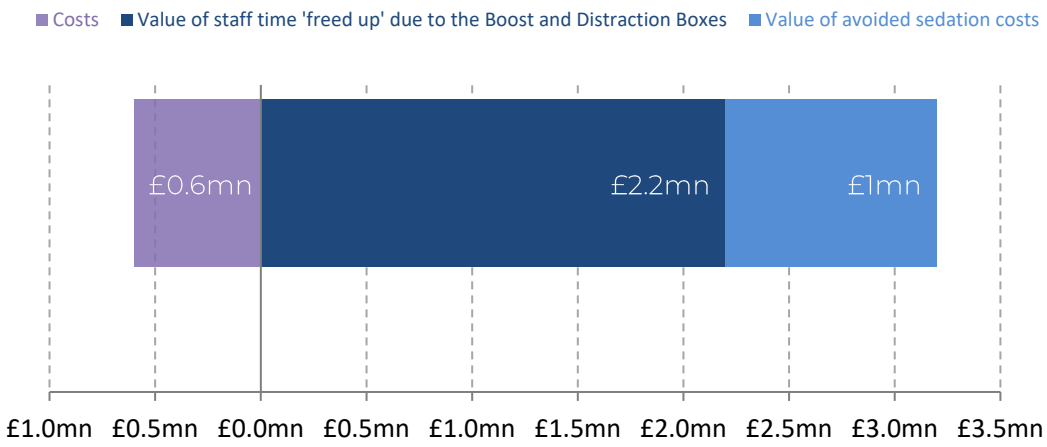
Furthermore, PBE estimated that sedation could be avoided in approximately one in every fourteen treatments, leading to saved sedation costs of £0.69 for the average treatment.[17] In other words, sedation may be avoided in as many as 100,000 treatments per year. This could generate as much as £1 million per year in economic benefits across the two programmes in the form of savings to the NHS.

Overall, Starlight's Distraction and Boost Boxes could generate benefits equivalent to £3.2 million per year, or £2.21 per treatment where the Distraction and Boost Boxes are used. Figure 2 illustrates the differences in magnitude of potential benefits arising from avoided sedation and quicker treatment time.

[16] This takes into account that PBE estimates from Starlight's data that one in three treatments are impacted by quicker treatment time

[17] This "per treatment" takes into account that PBE estimates from Starlight's data that one in 14 treatments are impacted by avoided sedation

Figure 2. The majority of estimated benefits come from shorter treatment time



Costs and break-even analysis

The financial costs, both direct and indirect, of Distraction and Boost Boxes are estimated to have totalled just over £600,000 in 2021-22, or £0.42 per treatment.

This means that just 19% of the potential time 'freed' and sedation benefits estimated by healthcare professionals would need to be realised for the benefits of the programme to outweigh its costs. In other words, only two minutes needs to be 'freed up' per treatment, or reduced sedation achieved for just one in every 76 treatments, for the box services to break-even.

Figure 3. Just 19% of the estimated benefits need to be realised for the benefits to outweigh the costs

	Estimated annual economic impact
Total economic benefits	£3,200,000
Of which from staff time	*£2,200,000*
Of which from sedation	*£1,000,000*
Total economic costs	£600,000

Scenario analysis

Scenario analysis explores the impact of key assumptions in the methodology and tests whether these conclusions remain robust.

Scenario 1: What happens if only the survey respondents experienced avoided sedation and quicker treatment time?

PBE challenged the assumption that the impact estimates from the survey sample of 105 healthcare professionals can be extended to all estimated 987 healthcare professionals that use the services. In this case, the economic costs of the Distraction and Boost Boxes would still be just over £600,000. However, the maximum economic benefits would only be those reported for the 105 professionals, i.e., approximately £400,000, resulting in a net economic cost of £200,000 in 2021-22. While this scenario would mean that the programmes do not deliver value for money, it is an extreme assumption, as it might seem unlikely that the remaining approximately 882 professionals experience none of the effects that the sample have reported. However, it still illustrates how strong the assumption is that the sample is representative. Dividing the outstanding cost of £200,000 by the estimated benefit per professional, the results suggested an estimated 53 more professionals (outside of the survey sample of 105) needed to experience the average benefits estimated in the report for the benefits to outweigh the costs.

Scenario 2: What happens if the avoided sedation impact, and its resulting costs, were overestimated?

PBE challenged the assumptions that: a) the dose cost of sedation is £10; and b) that the percentage of staff who reported a sedation impact in Starlight's feedback survey (which is separate to their economic impact survey) was representative of the total healthcare professional cohort. To do so, the extreme assumption modelled was that there are no avoided sedation impacts. In this case, the economic cost remained £600,000, but the maximum economic benefit possible would have been £2.2 million. In other words, only 28% of the estimated time 'freed up' per treatment needs to be realised for the benefits to outweigh the costs. This gave reassurance that even with the uncertainties around the sedation impact estimation, Starlight's services could deliver value for money.

Scenario 3: What if there was overlap in the use of Distraction and Boost Boxes?

Here it was assumed that there is maximum overlap in the treatments where Boost Boxes are used and where Distraction Boxes are used, i.e., that some treatments in the main analysis were double counted. Boost Boxes were estimated by Starlight to be accessed 200,000 times, and Distraction boxes 1. 3 million times in 2021-22. If there was actually maximum overlap in the allocation of these boxes to treatments, then the actual number of treatments where the boxes were used would be 1.3 million. In this case, the economic benefits would outweigh the costs if at least 22% of the maximum estimated sedation and time 'freed up' impacts were realised. This provided reassurance that any double counting of the number of treatments was unlikely to change the value for money conclusion significantly.

Scenario 4: What if the cost of the boxes was underestimated?

To test the robustness of the conclusion against the possibility that there were some costs unaccounted for, a 100% uplift was applied to the estimated costs in the main calculations. Even with a drastic uplift, the two services combined would generate a net economic benefit of almost £2 million a year; in other words, only 38% of the estimated impacts would need to be realised for the benefits to outweigh the costs.

Scenario 5: What if the value of staff time 'freed up' was overestimated?

There is a chance that PBE overestimated the hourly wage of health practitioner users of Starlight's resources. To test this, the extreme scenario that the value of staff time 'freed up' is zero was modelled. Even in this scenario, it was found that the services generate a net economic benefit of almost £400,000 a year. Therefore, if staff value were eliminated completely from the calculations, PBE found that the boxes would still generate value for money if at least 61% of the estimated impact of reduced use of sedation were realised.

Overall, while there was significant uncertainty about a number of the key assumptions in the model, the scenario analyses suggested that the benefits of the programme are likely to outweigh the costs provided that at

least 60% of the time 'freed up' and sedation savings estimated by professionals are realised, or that there are 53 professionals beyond the survey sample that have used the Distraction or Boost Boxes and realised the average benefits per staff estimated in this study.

Conclusion

This study of Starlight's Distraction and Boost Box services for children concluded that:

- A sample of 105 healthcare professionals estimated that the use of Distraction and/or Boost Boxes could shave off six minutes of time for the average treatment.
- When scaled up to the estimated 987 health play practitioners using the two programmes in 2021-22, this would be equivalent to over 6,500 staff days 'freed up' for reallocation each year – this staff time 'freed up' could be valued at £2.2 million.
- Sedation could be avoided in as many as 100,000 treatments per year, the equivalent of a saving of up to £1 million per year across the two programmes.
- Just one-fifth of the savings estimated by healthcare professionals would need to be realised for the benefits of the programme to offset its costs.
- In other words, only two minutes needs to be 'freed up' per treatment, or reduced sedation achieved for just one in every 76 treatments, for the box programmes to break-even.

It is important to recognise that these estimates were based on recollections of a relatively limited sample of healthcare professionals and are likely to be subject to significant uncertainty. However, savings could be one-fifth of those estimated here and the benefits of the programme would still offset its costs. In other words, only two minutes needs to be 'freed up' per treatment, or reduced sedation achieved for just one in every 76 treatments, for the two box programmes together to break-even.

Starlight's Distraction and Boost Box services could therefore deliver value for money, as well as alleviate time pressure on healthcare staff and reduce distress and anxiety for children in hospital. These impacts seem especially important at a time when NHS hospitals are struggling to keep up with growing demand for children's services.

To strengthen evidence of their Distraction and Boost Box services' impact in future, thereby allowing a more confident conclusion, PBE has advised that Starlight consider the following:

- Collect data on the number of healthcare professionals who use the services each year, rather than just those that order the boxes.
- Consistently use either "number of treatments" or "number of children" when estimating Starlight's reach and impact through surveys.
- Record the total number of health play practitioners that are sent data collection surveys to understand what proportion answer them.
- To understand the value of staff time impacted by reduced treatment time, collect data on the pay band of the respondent.
- Collect data on the sedation that would be used/is used during treatments.

Annex A – Data Summary

Detailed Economic Impact Survey 2021-22

Starlight collected responses from 105 healthcare professionals who used their Distraction and Boost Boxes in 2021-22. As part of this survey, data was collected on the professionals' responses relating to:

- Their own job title.
- Their judgement of how many children avoided sedation in the past month due to Starlight's resources.
- Their own judgment of how many children they saw in the last month who were impacted by quicker treatment time.
- Their own judgment of what the treatment time would be for those quicker treatments, both:
    - without Starlight's resources;
    - and with Starlight's resources.

Collective Reach and Impact 2021-22

Additionally, Starlight's Collective Reach and Impact 2021-22 data summarised responses from a survey of 583 healthcare professionals who administered treatment while making use of Starlight's resources, including the Distraction and Boost Boxes. This dataset contained estimates of:

- The number of times the boxes had been used.
- The number of respondents who reported that the boxes had reduced the need for sedation.

Orders List 2021-22

Starlight also shared with PBE its Orders List 2021-22 data. This indicated the number of healthcare staff who ordered boxes in 2021-22 was 987.

Financial Costs 2021/22

The charity collected the following data:

- Total direct and indirect costs attributable to their Distraction Boxes.
- Total direct and indirect costs attributable to their Boost Boxes.
- Estimated total number of accesses to Distraction Boxes by children.
- Estimated total number of accesses to Boost Boxes by children.

Starlight shared direct costs, including those arising from contents, storage, distribution and management. They also shared indirect costs, including those attributable to direct staffing, divisional staffing, and overheads.

Annex B – Measuring economic costs of Distraction and Boost Boxes

PBE used Starlight's financial cost data to estimate costs per year, per box and per treatment where Distraction or Boost Boxes have been used.

According to Starlight's financial data, in 2021-22, 3,764 Boost Boxes were distributed, costing £557,608 in total (direct costs of £294,024 and indirect costs of £263,584). In total, 717 Distraction Boxes were distributed, costing a total of £51,574 (direct costs of £27,195 and indirect costs of £24,379). Together, the two services combined that year totalled 4,481 boxes, and cost £609,182. Dividing the total cost by the total number of Distraction and Boost Boxes gave an average cost per box of £135.94.

Starlight estimated that, in the same year, Distraction Boxes were accessed 1,257,156 times by children. Boost Boxes were accessed an estimated 191,700 times. Combined, the number of accesses to both boxes was approximately 1,448,856. Some boxes are used more than once, especially Boost Boxes. Dividing the total cost of £609,182 by the total number of accesses 1,448,856, PBE therefore estimated that each access costs £0.42.

Annex C – Measuring economic benefits of staff time 'freed up'

Using the Collective Reach and Impact, Orders List and Detailed Economic Impact Survey data, PBE calculated the potential economic benefits in the form of the monetary value of staff time 'freed up' to reallocate to other work.

Note that from this point on, PBE has referenced numbers of "treatments", rather than "children treated". This is to allow for a common base in the evaluation; Starlight's Collective Reach and Impact dataset refers to "total number of accesses" (i.e., the number of times the Distraction and Boost Boxes were used during treatment), but the aforementioned healthcare professional survey makes reference to "number of children" impacted by avoided sedation or quicker treatment. It is possible that a child may have been treated more than once while Starlight's resources were used. However, given the data available, "number of children" was used as a proxy for "number of treatments", as it is reasonable to assume that respondents may tend to conflate the two when estimating "number of children".

Step 1: Estimating hourly wage of staff

Hourly wage was not captured in the Detailed Economic Impact Survey. PBE matched each job title recorded against those in the Unit Cost of Health and Social Care dataset to estimate their hourly wage. This step introduced the prospect of some human error while matching. To mitigate this risk, in cases where job titles could be matched to more than one role in the Unit Cost of Health and Social Care dataset, job titles were matched with the role in the dataset with the lowest hourly wage. This minimised the likelihood of overestimating the economic benefits in the analysis.

Step 2: Trimming time reduction responses

Subjective judgments regarding the number of treatments impacted by quicker treatment time, the average treatment time without Starlight's resources, and the average treatment time with them, all risk overestimation of the potential benefits of the services. To minimise this,

these responses were trimmed by identifying the upper and lower outlier bounds of each variable

$$Lower\ bound = Q_1 - 1.5IQR$$

$$Upper\ bound = Q_3 + 1.5IQR$$

where IQR is the interquartile range. Any values of a variable above its upper bound were recoded as the upper bound value. Any values of a variable below its lower bound were recoded as zero, because all lower bounds in these cases were negative values despite none of the responses being negative.

In six cases (out of the 89 who recorded a time saving) the data had to be cleaned because respondents said that there was a time-saving impact, but also reported the treatment time with Starlight resources as greater than without. Assuming that such cases were therefore errors, these numbers were switched. Interestingly, the average time 'freed up' response in the sample per month before cleaning and trimming the data was 14.7 minutes, which is exactly the same as the total time 'freed up' after cleaning and trimming. For each respondent, the reported number of quicker treatments in a month was multiplied by their time saving estimate. It was found that (only for treatments where time is 'freed up') the time saving is 17 minutes and 32 seconds.

Step 3: Estimating total cost and time saving for the sample

For each respondent, their time 'freed up' per quicker treatment estimate was multiplied by their estimated hourly wage. This was then multiplied by their estimated number of treatments impacted per month to calculate the potential benefits for each staff member arising from quicker treatments in the past month. These were summed across all respondents to find that the sample responses suggest a potential economic benefit of £19,500 in one month arising from staff time 'freed up'. Multiplying this by 12, the results suggested that the benefits for the sample over a year could have been as much as £234,000 across 57,060 treatments, or £4.11 per treatment.

Step 4: Estimating total cost and time saving for the whole year

Starlight's Collective Reach and Impact 2021-22 data suggests that children accessed the boxes 1,450,000 times. The charity's Order List 2021/22 data

suggested that 987 staff ordered the boxes in that year. It was not possible to trace the exact number of healthcare professionals who used the service, so PBE used the number of staff who ordered the boxes as a proxy.[18]

PBE divided the 57,060 treatments by 105 staff in the sample to estimate that there were 543 quicker treatments per staff member per year. Multiplying this by the 987 estimated total healthcare staff, the analysis suggested that approximately 536,000 treatments were quicker each year due to the boxes, equivalent to £2.2 million per year.

[18] Starlight advise that, through their research, staff ordering boxes usually do so for their wider healthcare team; therefore, this number may underestimate the total number of service users and thereby the economic benefits.

Annex D – Measuring economic benefits of avoided use of sedation

The following data was used to estimate the economic benefits of avoided sedation:

- In Starlight's survey of 105 healthcare professionals who used the services in 2021-22, data was collected on their judgement of how many children avoided sedation in the past month due to Starlight's resources.
- From the separate Collective Reach and Impact 2021-22 data, results suggest:
    - Overall, 31% of Distraction and Boost Box users (healthcare professionals) reported that the boxes avoided the need for sedation.
    - The boxes were accessed by children 1.4 million times.
- Starlight shared with PBE that the number of staff who ordered boxes in 2021-22 was 987.

Using this data, PBE calculated the potential economic benefits in the form of the saved costs of sedation due to the boxes.[19]

Step 1: Estimating sedation dose cost

PBE used an economic cost estimate for a dose of sedation of £10, following research by the National Institute for Health and Care Excellence (NICE) and Starlight's guidance that their research indicates avoided sedation usually relates to mild or moderate sedation, such as the use of nitrous oxide.

Step 2: Trimming avoided sedation responses

In Starlight's survey of 105 healthcare professionals who used the services in 2021-22, data was collected on their judgement of how many children avoided sedation in the past month due to Starlight's resources. Subjective judgments regarding the number of treatments where sedation was

[19] Note that from this point on, we refer to numbers of "treatments" rather than "children treated". See Annex B for more information.

avoided introduce human error. To minimise the risk of overestimating the potential numbers of treatments avoiding sedation due to Starlight, these responses were trimmed following the same method in Annex C.

Step 3: Estimating number of treatments impacted by avoided sedation in the sample and cost savings thereof

For each respondent, the number of treatments which they reported avoided sedation in a month was multiplied by the dosage cost. Overall, 63 staff in the sample reported avoided sedation as a result of Starlight's boxes. They reported that 1,700 treatments avoided sedation in a month. Multiplying by 12, PBE estimated that 20,400 treatments avoided sedation in a year when children were seen by health play practitioners in the sample, amounting to £204,000 in savings, or 324 treatments per staff per year.

Step 4: Estimating number of treatments impacted by avoided sedation in the year and cost savings thereof

Starlight's Collective Reach and Impact 2021-22 data suggested that 31% of healthcare staff using Distraction and Boost Boxes reported avoided sedation as an impact of the services.

It was therefore estimated that 309 staff, 31% of the estimated 987 total staff in 2021-22, would report avoided sedation when Starlight's resources were used in their treatments. Multiplying this by 324 treatments where sedation has been avoided per year, the results suggested that there were 100,000 cases of avoided sedation that year, or £1,000,000 in savings.

Annex E – Estimating total economic benefits and break-even point

The annual potential economic benefit arising from 'freed' staff time was combined with that of avoided sedation to estimate total economic benefits for the year as £3.2 million.

PBE conducted break-even analysis to understand how much of this potential economic benefit actually needs to be realised for the costs to be recovered by the service. The costs were divided by the benefits, leading to the conclusion that if at least 19% of the estimated potential benefits were realised, then the benefits outweighed the costs.

Annex F – Recommendations for future data collection

- Consistency in use of "number of treatments" and "number of children" – for this analysis PBE used "number of children" as a proxy for the number of treatments in which Starlight's resources were used. This is because the charity's survey asked respondents about the numbers of children impacted, but their Collective Reach and Impact data detailed only the number of treatments. However, the limitation of this is that a child may use the resources at more than one treatment. For future evaluation work, PBE recommended that Starlight choose to consistently either record the number of children impacted/reached, or the number of treatments.
- Similarly, PBE suggested collecting data on the number of health play practitioners per year (rather than number of staff who ordered boxes) to strengthen the estimates when extrapolating findings from sample data out to the whole population.
- Record before and after, at separate points. Asking respondents to judge what would happen before and after an intervention retrospectively can introduce human error, which in turn risks inaccuracy in analysis findings. PBE suggested that for future projects, Starlight consider asking at baseline the outcomes in question, and then again at intervention. For example, when estimating time impacts, Starlight could ask respondents for the time it takes to complete a treatment before they are introduced to the play resources. And then again they could ask respondents the same question once the resources are given to the health play practitioners.
- Ask for staff wage/pay band. To strengthen economic analysis in the future that may rely on valuing staff time freed up for reallocation elsewhere, Starlight were advised to consider asking the respondent's pay band (or indeed hourly salary, although this may not be a practical question to ask)
- Ask the same pool of users evaluation questions – it is uncertain to what extent the people represented in the Collective Reach and

Impact data, the survey data and the Orders List overlapped. PBE encouraged Starlight to collect data for evaluation from the same group of users, so that the charity can be sure that the underlying assumptions (e.g., how the sample is chosen) are consistent.

Annex G – Scenario analysis

Scenario analyses were conducted to test the strength of the main findings. This section outlines the calculations used behind the presented findings in the scenario analysis section of the report.

- Scenario analysis 1: What happens if only the survey respondents experienced avoided sedation and quicker treatment time?

  This scenario would result in a net economic cost of £171,000 in 2021-22.

  PBE then calculated how many more healthcare professionals would need to experience the estimated average avoided sedation and time savings impacts in the core results. PBE first estimated the marginal benefit per staff added in avoided sedation and 'freed up' treatment time. Dividing total estimated benefits by the total number of staff, the average benefit per staff was estimated to be £3,250. Dividing the outstanding £171,000 by £3,250 suggested approximately 53 more professionals need to experience the average benefits estimated in this report for the benefits to outweigh the costs.

- Scenario analysis 2: What happens if the avoided sedation impact, and its resulting costs, were overestimated?

  In this scenario, no benefits arise from avoided sedation. Dividing the £600,000 in services costs by the potential benefits of staff time of £2.2 million, it was estimated that if there were no sedation impacts and at least 28% of the estimated time saving were realised, then the benefits would outweigh the costs.

- Scenario analysis 3: What if there was overlap in the use of Distraction and Boost Boxes?

  If there was actually maximum overlap in the allocation of these boxes to treatments, then the actual number of treatments where the boxes were used is 1,3 million. The per treatment total benefits of £2.21 were multiplied by this number to estimate benefits of £2.8 million. Dividing total costs of £600,000 by this amount, it was estimated that the economic benefits would outweigh the costs if at

least 22% of the maximum estimated sedation and time saving impacts were realised.

- Scenario analysis 4: What if the cost of the boxes was underestimated?

  To test the robustness of the conclusion against the possibility that there are some costs unaccounted for, a 100% uplift was applied to the estimated costs in the main calculations. In this context, the estimated costs of the two programmes equalled £1.2 million a year. By subtracting this cost from the estimated benefit of £3.2 million, it was estimated the two services combined would generate a net economic benefit of almost £2 million a year. In this scenario, only 38% of the estimated impacts would need to be realised for the benefits to outweigh the costs.

- Scenario analysis 5: What if the value of staff time 'freed up' was overestimated?

  To test this, it was assumed that the value of staff time 'freed up' is zero. From the impact of avoided sedation, therefore, it was found that the services generated a net economic benefit of almost £400,000 a year, or £1 million in economic benefits compared to £600,000 in economic costs. Therefore, even if the value of staff time 'freed up' was 0% of what PBE estimated it to be, this analysis suggested that the boxes would still generate value for money if at least 61% of the estimated impact of reduced use of sedation were realised.

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