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How families prepare their children for tooth extraction under general anaesthesia: Family and clinical predictors of non-compliance with a 'serious game'

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PAR: Lead author, technology enhanced learning advice, conception and design of the automated data collection and final approval of the manuscript with all authors.

AND: Lead on statistical design of the Scott trial and this paper, design of data collection and analytical framework, direction, supervision and report of statistical analysis, and final approval of the manuscript.

CL: Provided paediatric psychology expertise and played a key role in computer package design, the overall design of the trial, the analytical framework, interpretation of findings, and final approval of the manuscript.

JTN: Contribution to the overall design of the SCOTT trial, the analytical framework, interpretation of findings, and final approval of the manuscript.

ND: Assistance with the statistical analysis of the log data and final approval of the manuscript.

RA: Assistance with the design of the automated log data capture and the statistical analysis.

PH: Collation and management of log data for statistical analysis.

RA: Blind observer for the VAS & YPAS scoring used in the analysis of the log data.

CH: Administration of the methods and results including access to online game, online site and collection of log data.

MTH: Conceived the study, led its design and coordination and is project manager; played a key role in the on-line preparatory game design along with CL, TJN and AND, Ensured the URL was linked to study ID and oversaw that the data collection adhered to this and contributed to the final approval of the manuscript.

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Summary

Objective: To explore family and clinical factors for usage of an online serious game designed to prepare children with ECC for dental treatment under general anaesthesia.

Design: Observational study. Secondary data of 60 children, aged 5-to-7, randomised to the intervention group in a phase-III randomised controlled trial [NIHR Portfolio 10006, ISRCTN: 18265148] testing the efficacy of the serious game http://www.scottga.org (available online). Usage was captured automatically, with each click, in real time. The total number of replays and total number of missing slides per game-run performed by the child, were recorded and used to monitor usage. Compliance outcomes were: total time running the game and number of completely missed slides.

Results. 57/60 played the game. Median age of parent/carer was 32. For 74% of the families, fathers resided at home and for 65% the parent/carer had A-levels-to-university education. At recruitment, 70% of the children were reported as anxious/highly-fearful and 37% as "significantly psychologically disturbed".

Conclusions. Factors for non-compliance were absence of a father (P=0.01) and higher child-anxiety (P=0.01) and, to a lesser extent, a low parent/carer education level (P=0.09). Interactive cartoons featuring dental assessment, oral health messages and modelling featured in the more popular slides.

Key words: Early childhood caries, general anaesthesia, psychological interventions, computer games, serious games.

Introduction

Computer-based interventions are gaining in popularity and have been used for health education, asthma, diabetes, stroke, cancer, psychological therapies, oral health education and preparation for surgery. A 'serious game' is defined as "a digital game created not with the primary purpose of pure entertainment, but with the intention of serious use such as in training, education, and healthcare"[1]. The interactive nature of the online intervention described here for healthcare education of children, and analysis of the logs created from the user's play, ensured that it conformed to the 'serious game' definition rather than just a message broadcast[1]. In 2012, a systematic review of the role of serious games in improving health related outcomes concluded that they may have potential for a broad application within healthcare and include a wide variety of socio-demographic groups[2], but how do families use them? Research is needed into social and psychological predictors of use of 'serious games', particularly those used in healthcare.

In the UK, families have good internet access due to government investment into high-speed broadband, even socio-economically disadvantaged ones, but to date, there are a few studies using serious games that have included socially disadvantaged subjects in their sample. Aljafari et al (2017) used a serious game (delivered via a touch tablet computer within the clinic and by a DVD to take home) to 55 (intervention group) children with Early Childhood Caries (ECC), whose disease was so severe as to warrant a general anaesthetic hospital admission for tooth extraction. Essentially all of the children came from socially deprived backgrounds; the game helped children to identify sugary foods, and a concealed 'trophy' password at the end of it confirmed that 34 of them, the older children, had completed play and the families reported that they had found it to be a highly satisfactory method of receiving oral health education. The study did not report how other family characteristics influenced play at home[3].

This was an on-line game (WebTIPS) used to prepare children prior to tonsillectomy and adenoidectomy, aimed at reducing pre-operative child anxiety. However, it was not intended as a 'stand-alone' game; it was delivered in combination with parental coping skill instruction, and questionnaires about parental anxiety, preferences and choices of pre-medication and the child's coping preferences[4]. The interest and cooperation in preparing a child for this event can be measured through the usage of this game and the automated logs were used as the specific tool to achieve this purpose. The researchers also relied on the families' self-reports of game usage.

In the UK, Early Childhood Caries (ECC) often leads to children being admitted to hospital for tooth extraction under general anaesthesia; over 60,000 in 2012/135. Previous studies show that many of these children are anxious, need multiple extractions, and also have psychological and behavioural disturbances[6,7]. An anaesthetic guideline recommends that the children are offered psychological preparation[8] but these families tend not to readily attend appointments so, delivering this is difficult to achieve, especially in this busy fast-through-put day surgery services. Campbell et al (2005) published one of the first RCTs that used a serious game to prepare them[9,10] but it was delivered by a nurse, in the hospital. A new 'stand-alone' on-line game, "Scott's Hospital Dental Visit" was based on the game tested by Campbell et al (2005)[9]. Scott's game was developed through literature review, parent/carer focus groups and anaesthetists' feedback, and was based on psychological principles: to include coping skill instruction, information and role-modelling. Scott's game was designed to prepare their child for their dental hospital treatment under general anaesthesia (GA). The recent Phase III random controlled trial (RCT) of Scott's game has shown that although it did not reduce these children's pre-operative anxiety, their families believed that it helped their children to cope better[11]. Scott's game is now freely available on-line: namely http://www.scottga.org and aimed to help parents/carers and children to prepare together at home prior to GA for tooth extraction. The object of this study is to report on how families of children with ECC used an

on-line ‘serious’ game designed to prepare their child for dental treatment under general anaesthesia, and to explore the family and clinical factors that predict use of the game.

Materials and Methods

This paper is an observational study of secondary data, the user-logs of the 60 families that participated in the intervention group of the Phase III RCT [ISRCTN: 18265148] where the primary aim was to test the efficacy of http://www.scottga.org in helping children aged 5 to 7 years to cope better with the dental GA visit. The participating families had children who had already been scheduled for tooth extraction under general anaesthesia due to caries in the Paediatric Dentistry and the Day Surgery Units at King’s College Hospital, London. The parents/carers gave written consent and children their written assent [South East London Research Ethics Committee 2 ref no.10/H0802/41]. The protocol[12] and results[11] are already published[6].

The content and presentational design of the new online game was theory driven, and then thorough piloting, using a beta version, proved that the game was feasible and acceptable to family users and other healthcare stakeholders before the Phase III RCT was conducted to test it[11,12,13]. All of the participating families had confirmed that they had access to a computer capable of playing a ‘You-Tube’ video, and could speak English. They were given access to the game at home approximately two weeks in advance of the GA hospital visit and then again via a laptop on their hospital bed on the day of the surgery. Each family had its own unique user login. The technical specifications of the game are in **Table 1**, representing the lowest and most common technical denominators available at the time of the trial.

Interactivity throughout was achieved by clicking on the slides both to access their content and also to move between them. The usage logs automatically recorded the clicks and were

time stamped. Game-players could only move one slide at a time to avoid haphazard viewing. Users were told that the game was complete before the last 'goodbye slide'.

A supporting paper-based guide for parents was created in Adobe InDesign CS5 using the same images, giving details of how to use the serious game and instructions on the best way that they could be involved in their child's preparation (Figure 1).

Once the phase III RCT was completed, the unique family identifier code was broken and an independent compiler (PH) matched each family's usage log to the other study variables. The data remained anonymised. The resultant automated usage log data was exported 'raw' into an Excel spreadsheet and passed to the statisticians team for analyses[14-18]. The data that was included in this analysis were as follows:

1.Family game usage: (a) the number of slides visited, (b) details of the number of slides that were missed in each game run or completely, (c) mean time per slide viewed and (d) the number of complete runs-through of the game. This method was developed through the initial beta testing of the serious game. Definitions of slide use terminology are listed in **Table 2**.

The final time stamp was the oral health education slide because, at the final click, the narrator said that this was the game-end. Therefore, the last "goodbye" slide was excluded from the analysis.

2. Family profile: (a) age, (b) gender, (c) ethnicity, (d) parents' educational attainment, (d) the number and status of family members in the child's home and (e) whether or not the family reported having "language barriers".

3. Child profile: (a) the parental report of the child's dental anxiety (a score of 18 and above on the MCDAS)[19] and their child's psychological status (Rutter)[20], (b) children's self-report of their anxiety using the Facial Image Scale (FIS)[21], at recruitment, before delivery of the game, (c) toothache severity (Bieri)[22] on the ward. The number of teeth to be extracted was also recorded.

4. As background information, the anxiety outcomes of the primary RCT (to provide the comparison of the actual usage of this 'serious game' with the level of anxiety of the child): the observed child anxiety before entering (Yale_T1), and again inside (Yale_T2), the anaesthetic induction room, using the aggregate (sum) of the five items of the modified Yale Pre-operative Anxiety Scale (m-YPAS)[23] and (e) child co-operation with the anaesthetic induction, scored using a 10cm Visual Analogue Scale[24] (VAS, with larger values indicating worse behaviour) by a blind observer trained and calibrated in an external pilot study, prior to the start of the Phase III RCT[11]. During the Phase III RCT, the anaesthetic induction was video recorded, and she, re-scored 36 videos using the VAS, yielding an intra-observer reproducibility (intra-class correlation: ICC) of 0.87 (95% CI 0.79-0.95). A second blinded clinical observer, scored the same videos (inter-observer) ICC=0.77 (95% CI 0.63 to 0.92). Bland-Altman plots confirmed the intra and inter observer reproducibility [11,12].

Patient and Public Involvement

Before the phase III RCT, five specialists in paediatric dentistry, five theatre staff and fifteen parents of children attending GA appointments for dental extractions at the Kings College Hospital Day Surgery Unit were shown the computer game used in the Campbell at al (2005) study[9] and one-to-one semi-structured interviews were then conducted. An interactive design, informative content and ease of use were reported as the important features and parents were particularly interested in the incorporation of age-appropriate animation, child-friendly colour schemes and a clear but concise voice-over narration. During the development of www.scottga.org, a further eleven families gave feedback on the content and trial design.

Statistical Analysis Plan

The main compliance-related outcomes were the "time spent per slide" and the "number of slides missed". Comparisons between groups or levels of categorical variables (e.g.

demographics like gender, marital status, etc.) are performed using analysis of variance (including two-sample t-tests) or Kruskal-Wallis (including Mann-Whitney tests), according to normality. Associations of continuous outcomes with the continuous clinical variables are assessed using generalized linear models (linear, logistic or ordinal regressions).

The outcome "number of slides missed" exhibited a highly skewed distribution and was dichotomized (missing none vs missing one or more slides). Chi-square tests and chi-square for trend were used to compare the proportion of families missing one or more slides across the levels of categorical and ordinal variables, respectively. Logistic regression was used to model the likelihood of missing one or more slides in terms of children's family and clinical profile indicators measured before delivery of the game.

Results

From 60 participating families, four were lost to follow-up because they did not attend for the general anaesthetic visit within the study capture time-frame of the Phase III RCT, and they had some, but not all the family and child profile information. Since they had been given access to the game they were included in the analysis. Details of the reporting parent/carers' age, marital status and level of educational attainment are shown in **Table 3**. Twenty-three families (38%) described themselves as being of 'White' ethnicity and 15 (25%) of 'Black' ethnicity. All families reported having a mother at home. Language barriers were reported by 15 parents/carers (26%). Regarding the children, they had a mean age of 6 years; 29 (48%) were boys. Forty-two parents/carers reported that their children were anxious/ highly fearful (18+ MCDAS) and 22 parents reported that their child had clinically significant psychological disturbance.

In respect to how the 60 families used the game, only three did not play it, 12 used it at home beforehand and then again on the ward, 11 used it at home beforehand but didn't play it on the ward, 31 only played it on the ward, and three played it on the ward for the first time

and then again at home afterwards. All of those who did play it reached at least the live video-modelling (slide nine). Eight families did not miss any of the slides. Twenty families had more than one run-through. The 'Dental Chair' was the most popular slide that they (17 families) re-listened to (clicking on the 'listen-again ear') and 'tooth-brushing/caries/ prevention instruction' the most popular to re-play (14 families). The slide most skipped was 'Goodbye' (38 families). Fourteen per cent of families completed all of the slides and 40.4% missed one slide only. The number of completely missed slides ranged from 0 to 13, with a mean of 1.3 (SD=2.3). The median number of completely missed slides was '1' with an interquartile (IQ) range 0 to 3 slides. Family usage is detailed in **Table 5**.

Thirty-eight families (63%) had one complete run-through and 19 (32%) had more, the range was 0-10. When complete run-throughs are compared against missing two or more slides; of the 38 families who had one run-through, ten missed two or more slides (26%); of the nine families that had two runs-through, six missed two of more slides (67%) and for the 10 families that had more than two runs-through, ten missed two or more slides (100%). It may be interesting to note that the odds of missing one or more slides per game run was almost triple for those that did additional runs-through of the game (OR=2.7; CI 1.3 to 6.2 P=0.01).

Regarding the time spent per slide, this variable was highly skewed, range was 20 to 83 seconds, with a median of 26 seconds and IQ-range 23 to 28 seconds. The mean was 28.2 (SD=10) seconds. On Kruskal-Wallis, no significant associations with this outcome were found for child's demographics: age (P=0.32) or gender (P=0.33), parents' education levels (P=0.29), father at home P=0.81, parent's age (P=0.25) or ethnicity (P=0.56). In terms of the median time spent per slide, there was no significant difference between the groups missing 0 and 1+ slides (P=0.16). Similar results are obtained if time is truncated at 40 minutes.

On linear and ordinal regressions, none of the following clinical measures was found to have an association with the *mean time spent per slide*: Parental report of child anxiety (MCDAS)[19] (P=0.28); Child report of their anxiety at recruitment before playing the

serious game (FIS)[21] P=0.87; Severity of toothache (Bieri)[22] (P=0.78) and number of teeth to be extracted (P=0.77). (As background information, none of the outcomes for effectiveness was found to be associated with this compliance related outcome in this group: anaesthetic induction cooperation (Yale)[23] measured in the anaesthetic induction room and during anaesthetic induction: Yale_T1 (P=0.71) and Yale_T2 (P=0.45) respectively; anaestethic cooperation measured by the blind observer: VAS (P=0.19)).

Table 3 also presents the results of the (univariate) associations of completely missing one or more slides with the child's family and clinical profile before playing the serious game. The only socio-demographic variable that was found significant was the presence of a father at home which significantly reduced the percentage of children missing one or more slides from 90% to 59.5% (P=0.02). For those without a father present at home in relation to those with, the odds of completely missing one or more slides were 6-fold (95% C.I. 1.2 to 31). The child's self-assessed anxiety score (FIS), before playing the serious game, was found to be significantly associated with compliance: in relation to those children reporting to feel relaxed/no-worried, the odds of completely missing one or more slides was 7-fold for those children reporting to be from little to extremely worried (95% C.I. 1.5 to 36; P=0.01). There were no other significant findings for this compliance-related outcome. On multivariate logistic regression (Table 4), the effects of a father at home and the child self reported anxiety (FIS) at recruitment, were found to be independent and remained significant for this compliance outcome.

The parents' education level showed a noticeable trend: the percentage of children missing one or more slides was 81% for parents with None/GCSE/O-level, in contrast to 64% for parents with A-Levels and higher (Diploma, NVQ, University and Postgraduate). The odds of missing one or more slides for highly educated in relation to lower-educated families were 2.4 fold (95% C.I. 0.7 to 8; P=0.17). Although this difference was not found to be statistically significant, one should consider that, as an analysis of secondary data, the study was not

powered for this association. In fact, in the presence of child's anxiety at recruitment (Anxiety-FIS) and father at home, the education level of the parent/carer gained significance for this compliance outcome (Table 4).

In contrast, the number of teeth to be extracted, which showed a rather noticeable trend univariately (P=0.08), was explored in the multivariate model but was not found to retain that level of significance and, moreover, it was not found to have any effect after all. And, as shown in the bottom part of Table 3, none of the outcomes for effectiveness, at arrival in the induction room and during the procedure, was found to be associated with the likelihood of completely missing one or more slides in this intervention group.

Fourteen children did not co-operate during the general anaesthetic induction. **Table 6** summarises the number of runs-through and skipped slides compared to the 43 children who were co-operative. The children who co-operated poorly with the general anaesthetic induction appeared to have had more runs-through, clicked on more extra information, had less slides missed and they also spent a longer time playing the game. However, these findings were not statistically significant.

Parents/carers' views about the game were collected during the 48-hour follow-up phone call. A significant majority expressed the views that "The on-line game helped the child understand what was going to happen/ what to expect from their GA experience" (N=41), that "Child or family felt prepared due to having used the on-line game" (N=35) and that "The information was helpful, positive and/or good for assisting the child with the experience" (N=30) [11].

Discussion

The majority of families (randomized to the active group) played the game on the ward and a 40% of them had also played it at home in advance. The majority of families had one or two runs-through of the game, but it was the better-educated parents/carers who engaged the

most. Research by Kain and co-workers (2006) also found that it was the better-educated parents who tried to support their children more during anaesthetic induction[25]. The implication of the present study is that "serious games" need to be constructed to appeal to families with lower educational attainment. As such, interactive video, live modelling, but with the additional support of and live 'human' staff might still be the most appropriate way of delivering health care related serious games to them. Future research into health care games needs to be cognisant of the educational and socio-economic status of their targeted recruits[26].

The parents reported that they believed that using the on-line preparation helped their child to understand what was going to happen during the hospital procedure and helped their child to prepare. They thought that the child liked this type of interaction and that this led to less anxiety on the day of the treatment[11]. Over half of the families accessed the 'extra information' slides on their first run-through. This demonstrates interactivity with the game, and curiosity, but without observational data there is no way of telling whether this was random clicking or a genuine interest. The dental chair assessment visit cartoon was very popular; perhaps it captured the interest of the child? The most revisited slide was the 'tooth-brushing and the oral health education' messages. This slide was at the end of the game and the families would have needed to skip through a lot of slides to get to it, or reverse backwards from the end of the game. The need for the child to have so many teeth extracted might have given the family pause to think about the consequences of tooth decay and provide this 'teachable moment' when they were open to receiving oral health care messages. As such, the popularity of this slide, especially given that these were predominantly families of children with early childhood caries, is reassuring. However, this finding needs to be interpreted with caution, since there is no supporting observational data.

Overall, 57/60 families in our sample engaged with the game in some respect, with 26 of them using it at home, and reaching at least the live video-modelling slide. Each time that they replayed the game, the families missed more slides but they had been encouraged to play

the game on the ward as part of the Phase III RCT protocol[12] and it was likely that they knew which slides they wanted to see again, e.g. the live-modelling videos, and navigated towards them, though random clicking cannot be ruled out. Also, since families were waiting on the ward for the child to be taken into the anaesthetic induction room, they may have become distracted or interrupted by the routine checks and admission procedures. This could explain the wide variation in the 'time per click' data. Prensky, in a series of articles (2001-6) showed that there are many facets to the interactivity and engagement with web-based games in children[27,28.29.]

Alternatively, the families who did not use the game, or skipped through some slides, might have preferred not to let their child know about the surgery to avoid anxiety. Some researchers have also suggested that preparation might make the child more upset especially if the intervention was not timed sufficiently close to the operative procedure itself[30,31]. Our analysis suggests that there is a relationship between the child's anxiety (FIS) at recruitment and the families' engagement with the game and compliance, and 14 children that did not co-operate during their anaesthetic induction appear to have engaged with the game. This is an area that warrants further study.

As a result of this research, the automated logs is a tool that acts as a source of interaction to encourage and monitor compliance. However, it is not possible to measure, with a reliable score, the preparation of families for such an event and this is a limitation of this study. Another limitation of this study is that there was no way to detect if a family had left the computer unattended and, although the usage-data from those who spent more than 10 minutes per slide was not included in the analysis, caution is advised in interpreting the results without observational information. Observing inside the families' homes would have been intrusive; families would have had to agree to being filmed. Also, the end-point of the game was not well enough defined; a 'hidden password' or a 'champion's trophy' or asking the family or child to score their experience would have improved the study design. This area of

serious game design is still developing in the literature[32, 33]. A theory driven approach to design and a data driven approach to analysis[34], as presented here, together with observational evaluations will allow the knowledgebase to grow.

Most notably, this study is one of the few to recruit and retain 'hard-to-reach families[35]. Whilst the sample profile matches those reported in previous studies of this ECC child GA patient cohort in the UK[7,36]. However, non-English speaking families were excluded and so some of the immigrant and ethnic communities within London were not represented. Therefore, whilst the type of usage of the on-line serious game might be generalisable to children and families from similar low socio-economically deprived groups, further studies will be required to access how other ethnic groups and cultures engage with on-line serious games.

This secondary analysis of a Phase III RCT has shown that ECC families missed out more slides each time that they played the game and that those with lower parental educational attainment were over three times more likely to skip slides. The most replayed slides were the cartoon of the initial dental assessment visit, the oral health education messages, and the live-actor modelling videos portraying maternal support and child coping.

Conclusions

This secondary analysis of data from a RCT Phase III trial explored how families used an interactive on-line "serious game" that was designed to help children to cope with a general anaesthetic visit for tooth extraction. Notwithstanding the accepted limitations of the carefully designed game and technological build, 57/60 children and their families were able to access and use the web-based interactive educational resource. Detailed usage logs collected from playing the game were compared statistically with data from the RCT Phase III trial. Interactive cartoons featuring dental assessment, oral health messages and modelling featured in the more popular slides. The significant findings were that the odds of missing one or more slides were:

- 11-times larger for children with high self-reported anxiety and
- 7-times larger for children with their father not residing at home.

Lower parent/carer education was found to have contributed to completely missing slides. The serious game is now openly available at www.scottga.org.

Why this paper is important to paediatric dentists

- This is the first paper to report on how families of 5-7 year old children with ECC who needed tooth extraction under general anaesthesia used an on-line 'serious' game, and shows that they mainly used it within the clinic, rather than at home.
- Families skipped through slides with repeated viewings but seemed to target seeing the dental assessment visit, the oral health education information and the live video modelling of a child coping with the hospital visit.
- The families with the least well-educated parents/carers missed out more slides than the more well-educated parents/carers.

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Table 1 Technical specifications of access to the game and its development

Technical specifications		
Patient and Family Access		
	Technical Requirement	Comments
PC/laptop	Internet Connected Broadband or Wireless >54Mbps	Adobe Flash enabled (version 8)
Mobiles/tablets	Game not designed for smaller slides	Playable only if flash enabled
Platform	Windows or Mac	
Browsers	Internet Explorer and Safari	Common browsers only
Audio	Headphones or Speakers	Sound enabled
Game Development		
Original Drawings	Adobe Freehand MX Saved as vector PDFs	http://www.adobe.com/uk/products/freehand/
Editing	Adobe Illustrator CS5	To correct colour and vector issues (http://www.adobe.com/uk/products/illustrator.html)
Animations	Adobe Flash CS5	To animate key parts of the drawings e.g. taking blood pressure http://tv.adobe.com/product/flash).
Videos	Flash (.flv files)	Two live actor scripted videos to provide psychological behavioural modelling; as well as cartoon-based preparation and coping skill instruction information.
Navigation	Interactive arrows Hot spots on images	Mouse clicking forward and back between slides*, "What happens next" audio cue to click and move to next slide*
Extra user information	Interactive dinosaur images and ear icons	Extra information window pop-up from dinosaur egg* Repeat of narration from ear icon*
No of Slides	14 interactive web-based slides* 2 video slides* 6 game procedural slides *	Procedural slides included: Loaded and accessed slides 'Welcome' and 'Goodbye' slides Two-part 'returning home' slide Final Oral Health Message slide
Site access	Hosted by King's College London Server now with open access http://www.scottga.org	Initial slide checks audio functionality and flash compliancy with password protected access for the trial.
*Recorded in the Usage Log during the trial		

Table 2. Definitions of terminology adopted for slide use

Definitions of terminology adopted for slide use	
Missed slide	Not visited at all up to the last slide of the story (Scott taking an analgesic at home) and were counted from the site-loading slide onwards.
Complete 'run-through'	A visit to each slide in the forward direction up to the last slide of the story (Scott taking an analgesic at home afterwards)
Site 'accessed' and site 'loaded'	The first two user-data-logged slides. They were not counted as part of a 'run-through' since the time taken to load the game was dependant on the computer that the family had used. This approach also ensured that the game was loaded and running during the game-play analysis.
Slide 'not complete'	Any slide for which the time exceeded 10 minutes without further clicking as there was no observational information on whether or not the participants/family were still viewing the game.

Table 3
Associations of compliance (missing one or more slides) with the child's family and clinical profiles

	Counts N=60	% missing 1+ slides	P-value [test] Univariate
Family's Profile			
Child age *(bands 5 - 6 - 7 years)*	20-19-21	60%-74% -76%	0.26[2]
Child Gender Boys - Girls	29-31	67.7% - 62.4%	0.69[2]
Father at home Yes-No	37-20	59.5% - 90%	0.02[2]
Other-adult at home Yes-No	8-49	87.5%-67.4%	0.25[2]
Siblings at home Yes – No	9-30	77.8% - 68.6%	0.58[2]
Ethnicity			0.39[2]
White	23	69.6%	
Black	15	60.0%	
Mixed/Asian/Other	17	82.4%	
Language Barriers Yes-No	45 -15	71% - 67%	0.75[2]
Parent Age-group			0.89[3]
19-24	3	100%	
25-29	8	87.5%	
30-34	15	60%	
35-39	12	66.7%	
40+	19	68.4%	
Parenting marital status.			0.46[2]
Single	10	90.0%	
Married	30	60.0%	
Living together	9	66.7%	
Living apart	7	85.7%	
Parent with other	1	100.0%	
Parent qualification			0.17[2]
None/GCSE/O-Level	21	81%	
A Levels/ Diploma/NVQ/University-Postgrad	39	64%	
Clinical Profile (Previous to playing serious game)			
Number of teeth extracted.			0.13[3]
3-4	19	52.6%	
5-6-7	16	75.0%	
8-9-10	25	80.0%	
Pre-op toothache severity (Bieri) Yes-No	35 - 25	65.7% - 76%	0.39[2]
Rutter Total. Psychological profile. Range 0-28			0.44[4]
10- VS Above 10	38-22	74% - 64%	0.41[2]
Child anxiety parent/carer assessed before serious game MCDAS range 1-5: Below 3 VS 3+	34-20	74% -65%	0.74[1] 0.50[2]
How worried child feels (FIS), at recruitment, before exposed to serious game: *Worried VS No-worried*	22 - 38	91% - 58%	0.01[2]
At arrival in induction room and during induction			
How worried child feels (FIS), at arrival for induction. *Worried VS No-worried*	36-24	78% - 58%	0.11[2]
Behaviour at induction (VAS Range 0-10)			0.79[1]
4+ VS Below 4	29 - 31	66% - 74%	0.46[2]
Distress/anxiety (YPAS 1-5) at arrival for induction			0.78[1]
1.5 and above vs less than 1.5	34 - 26	67.7% - 73%	0.65[2]
Distress/anxiety (YPAS 1-5) at induction			0.89[1]
2 and above VS less than 2	29 – 31	65.5% - 74.2%	0.46[2]

[1]Two-sample t; [2]Pearson Chi-square; [3]Chi-square for trend; [4]Logistic regression

Table 4 Multivariate logistic regression for the likelihood of missing one or more slides.

Missed one or more slides	Odds Ratio	95% Confidence Interval		P-value
Anxiety FIS at recruitment (before game) *Worried VS relaxed/no-worried*	11.0	1.89	64.11	0.01
Father at home: *Yes vs No*	0.11	0.02	0.61	0.01
Education of Parent/Carer *A Levels/ Diploma/University-Postgrad VS None/GCSE/O-Level*	0.27	0.06	1.23	0.09

Table 5 Family usage summary

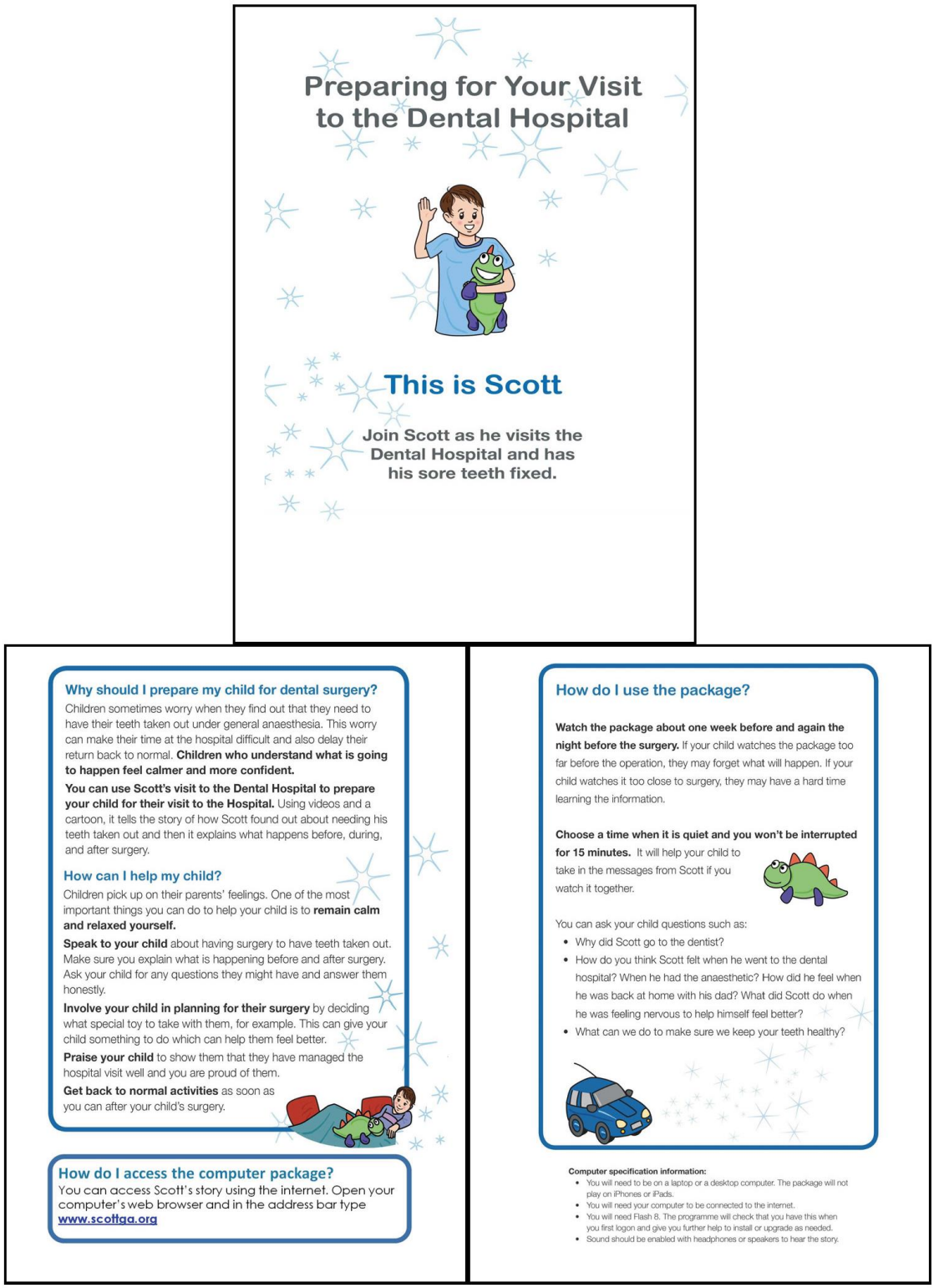
Game usage	**Number**	**%**
Total number of participating families who played the game	54/57	95.0
Players who accessed the game at home only	11/57	19.3
Players who accessed the game on the ward only	31/57	54.4
Players who accessed the game both at home and on the ward	15/57	26.3
Players with more than 1 run-through	20/57	35.1
Players accessing the game at least once	54/57	94.7
Players with more than one complete run-through	12/57	21.1
Players skipping at least 1 slide	50/57	87.7
Players reaching the video of modelling of child coping (slide 9)	57/57	100
Total extra information links clicked	120	
Extra information links clicked in the first run-through	61/120	50.8
Slide skipped the most was 'Goodbye'	38/57	66.7
Dental chair assessment visit re-listening	17/49	34.7
Tooth brushing slide revisiting	14/98	14.3
Time stamp data	**(hh:mm:ss)**	
Range of time spent on the game	00:04:12 - 01:48:19	
Average time taken per run-through	00:10:05	
Average time taken per slide (assuming 14 story slides)	00:00:43	

Table 6 Child co-operation at GA induction in respect to runs-through and missed slides

	No. of runs	No. extra info slides	No. of total slides missed	No. of completely missed slides	Time spent on game h:m:s
Children who were co-operative at anaesthetic induction (43/57)					
mean	1.6	1.5	9.6	1.5	00:10:62
median	1	0	1	1	00:07:21
Children who were not co-operative at anaesthetic induction (14/57)					
mean	2.2	2.6	7.9	1	00:16:36
median	1	1	2	1	00:07:63

Figure 1

Parent / carer information pamphlet



Preparing for Your Visit to the Dental Hospital

This is Scott

Join Scott as he visits the Dental Hospital and has his sore teeth fixed.

Why should I prepare my child for dental surgery?

Children sometimes worry when they find out that they need to have their teeth taken out under general anaesthesia. This worry can make their time at the hospital difficult and also delay their return back to normal. **Children who understand what is going to happen feel calmer and more confident.**

You can use Scott's visit to the Dental Hospital to prepare your child for their visit to the Hospital. Using videos and a cartoon, it tells the story of how Scott found out about needing his teeth taken out and then it explains what happens before, during, and after surgery.

How can I help my child?

Children pick up on their parents' feelings. One of the most important things you can do to help your child is to **remain calm and relaxed yourself.**

Speak to your child about having surgery to have teeth taken out. Make sure you explain what is happening before and after surgery. Ask your child for any questions they might have and answer them honestly.

Involve your child in planning for their surgery by deciding what special toy to take with them, for example. This can give your child something to do which can help them feel better.

Praise your child to show them that they have managed the hospital visit well and you are proud of them.

Get back to normal activities as soon as you can after your child's surgery.

How do I access the computer package?

You can access Scott's story using the internet. Open your computer's web browser and in the address bar type www.scottga.org

How do I use the package?

Watch the package about one week before and again the night before the surgery. If your child watches the package too far before the operation, they may forget what will happen. If your child watches it too close to surgery, they may have a hard time learning the information.

Choose a time when it is quiet and you won't be interrupted for 15 minutes. It will help your child to take in the messages from Scott if you watch it together.

You can ask your child questions such as:

- Why did Scott go to the dentist?
- How do you think Scott felt when he went to the dental hospital? When he had the anaesthetic? How did he feel when he was back at home with his dad? What did Scott do when he was feeling nervous to help himself feel better?
- What can we do to make sure we keep your teeth healthy?

Computer specification information:

- You will need to be on a laptop or a desktop computer. The package will not play on iPhones or iPads.
- You will need your computer to be connected to the internet.
- You will need Flash 8. The programme will check that you have this when you first logon and give you further help to install or upgrade as needed.
- Sound should be enabled with headphones or speakers to hear the story.