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Co-production of a mobile application for parents of acutely ill children under five: 'iPoorly child symptom checker'

Sarah Neill [a,*], Amy Rathbone [a], John Downey [a], Monica Lakhanpaul [b], Damian Roland [c], Matt Carey [a]

[a] University of Plymouth, Plymouth, UK
[b] University College London, London, UK
[c] University of Leicester, Leicester, UK

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ABSTRACT

Acutely-ill children under five years are increasing users of urgent and emergency care with no increase in acuity of presenting illnesses. This raises concerns about parents' knowledge and confidence in assessing the severity of symptoms of acute illness, despite the abundance of digital information available.

Method: We co-designed the iPoorly child symptom checker app using experience-based co-design methodology with seven parents and seven health professional patient and public involvement representatives. The prototype was iteratively developed on a no-code platform, then released for testing on android and iOS app stores for six weeks. The app was downloaded 603 times and 60% of users completed the embedded evaluation form.

Results: System usability scale items were all positively scored by 91% to 53% of respondents. Thematic analysis of open text responses identified that respondents found the app easy to use and reported that it enhanced their understanding of acute childhood illness, increased their confidence in caring for their child, reassured them about their child's illness and/or helped them to decide whether or not to seek medical help.

Conclusion: These findings show that providing parents with accessible, trustworthy information on symptoms of childhood illness increases knowledge, understanding and confidence in caring and seeking help for a sick child. The results demonstrate proof of concept for this co-developed prototype app and the iterative process of development.

Implications for practice: Apps can be a powerful adjunct to information resources nurses provide for parents and should be embedded in health services for children.

Acute illness in children under five years accounts for a significant share of general practice consultations (Hobbs et al., 2016) and a steadily increasing share of urgent and emergency care visits (Ruzangi et al., 2020), despite a declining child population and no rise in illness severity (Neill et al., 2024). Evidence suggests that low health literacy contributes to non-urgent emergency department (ED) use (Jensen et al., 2025), yet existing digital resources fail to adequately support parents in managing acutely ill children. As mobile technology has become ubiquitous (Rathbone and Prescott, 2017), mHealth apps have shown promise in improving health outcomes for adults and children with long-term conditions (Cruz-Ramos et al., 2022; Mörelius, Robinson, Arabiat, and Whitehead, 2021; Palos-Sanchez, Saura, Rios Martin, and Aguayo-Camacho, 2021; Rathbone and Prescott, 2017), and their role in acute childhood illness has been explored in low-income settings (Desmond et al., 2024; Ellington et al., 2021; Mahmood et al., 2020).

The UK's National Health Service (NHS) Long Term Plan (NHS, 2019) and recent government policy (UK Government, 2025) place a strong emphasis on digital transformation, including mobile health innovations. However, effective implementation requires co-production and co-design to ensure usefulness, ease of use, trustworthiness, security and relevance to acute illness (Benoit, Hartling, Chan, and Scott, 2021; Desmond et al., 2024; Rathbone, Neill, Prime, Thomas, and Everett, 2024).

Young children experience frequent episodes of acute illness, commonly infectious in nature, and are high users of primary and emergency care (Public Health England, 2021). In 2023–2024, there were over 2.4 million ED attendances for children aged 0–4, a slight increase from 2021–2022, and their ED attendance rate is higher than any age group except the over-75 s (NHS England, 2024). Costs per ED visit range from £137 to £445, underscoring the resource burden (The Kings Fund, 2024). Despite the NHS's LTP to digitalise care and an

* Corresponding author.
E-mail addresses: sarah.neill@plymouth.ac.uk (S. Neill), john.downey@plymouth.ac.uk (J. Downey), m.lakpanpaul@ucl.ac.uk (M. Lakhanpaul), dr98@leicester.ac.uk (D. Roland), matthew.carey@plymouth.ac.uk (M. Carey).

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ever-increasing availability of online and mHealth resources in addition to a range of digital health interventions (DHIs) (Greenhalgh et al., 2021; Hughes et al., 2022), this trend has continued. There is considerable ambiguity in defining DHIs (Fatehi, Samadbeik, and Kazemi, 2020) with the World Health Organization's classification system highlighting the diversity of approaches. The COVID-19 pandemic accelerated DHI adoption, yet, to date, no UK DHI aligns with parents' preferences for managing acutely ill children. Our systematic review found only seven relevant research reports worldwide, none from the UK (Carey et al., 2025), and none of the 15 UK mobile apps, identified in our environment scan of UK apps, published evaluation data (Rathbone et al., 2024). Most lacked parent involvement in development, which may explain their limited impact.

The Acutely Sick Kid Safety Netting Interventions for Families (ASK SNIFF) research programme (Neill et al., 2024) has provided the evidence base for the iPoorly Child Symptom Checker. The programme utilised a longitudinal, six step process, involving collaboration with a total of 147 parent and 324 health professional participants over a period of six years including: scoping existing interventions, systematic review, qualitative research, video capture, content identification and development, consensus methodology, parent and expert clinical review (Neill et al., 2024). We have not been able to identify any other resource that has used this approach, which may explain why there is no published evaluation data demonstrating the impact of existing UK resources.

iPoorly is a mobile app to help parents recognise when to seek help for acutely ill children. It emphasised parents' desire for symptom-focused information, visual aids (e.g. videos, traffic-light systems), and professional endorsement. The ASK SNIFF programme concluded that accurate, accessible information and co-production are critical for parental decision support, but producing and evaluating such interventions is challenging and time-consuming. Robust evaluation data is urgently needed to assess the impact of digital interventions.

Project aim

The project reported here is the co-production and co-design of a prototype mobile app with, and for, parents to help them know when to seek help for an acutely ill child under five years of age. The content and structure are based on the preceding work of the ASK SNIFF programme mentioned above (Neill et al., 2024).

iPoorly mobile App

Parents named the resulting 'iPoorly: Child Symptom Checker app'. Parents and carers can use the app to explore age specific information on the commonest presenting symptoms of acute illness in young children (body temperature, breathing difficulties, dehydration, vomiting, diarrhoea, and rashes), receive information on the severity of the child's symptoms, how to care for them and when to seek help. The team partnered with an online, no code app development platform, named Cogniss. No code development platforms allow applications to be built without needing to write the digital coding.

Methodology

Experience based co-production and co-design

An experience-based co-design (EBCD) methodology was used throughout the development of the iPoorly prototype app. This approach is congruent with the embedded user involvement in the underpinning ASK SNIFF work reflecting the importance of co-production with end users. EBCD is a user-focused, participatory design approach (Farr, 2019; Masterson, Areskoug Josefsson, Robert, Nylander, and Kjellström, 2022), typically employed to improve the quality, delivery, and dissemination of health care services and/or resources. This outcome is accomplished by actively integrating patients and professionals as fully fledged partners in the research, as opposed to passive participants (Fylan and Fylan, 2021). This essentially means that intent to use should be improved by involving targeted users in the design process. The EBCD methodology considers that the experience and emotions of the users who are receiving a particular type of care, or the healthcare professionals who deliver it, provide vital insights to healthcare, encouraging meaningful change and longitudinal uptake. Personal narratives of the experiences of all stakeholders involved are used to capture positive and negative touchpoints (Fylan and Fylan, 2021; Tsianakas et al., 2012). When researchers partner effectively with the intended users and deliverers of a DHI to navigate its optimal development, all involved have an opportunity to shape the development of the resource. Each of the stages in the project are depicted in the iPoorly Proof of Concept Workflow (Fig. 1).

Recruiting our co-designers

Public and patient involvement and engagement (PPIE) was a crucial aspect of the ASK SNIFF research programme and in this project it also included health professionals as they are an important user group for mHealth. Parents and carers were recruited from a database held by the ASK SNIFF collaborative research team while health professionals were recruited through the professional network of the health professionals in the research team. These PPIE group members were contacted directly by a dedicated PPIE Lead who was responsible for PPIE recruitment. PPIE parents and health professionals were provided with information about the parameters of the app development, and what being involved in the co-design of the App would involve written in a participant information sheet (PIS) and a consent form. We followed best ethical practice even though, as product development work, this project did not require ethical approval.

Patient and public involvement and engagement members. Overall, there were seven parent and seven health professionals PPIE members involved in the EBCD process for the iPoorly prototype app development. All seven parents had one child under five years - six were mothers and one was a father, aged between 25 and 44. Children were aged between one and four years of age. Parents came from three different areas of the UK: London ($n = 4$), the South West ($n = 2$) and the North West ($n = 1$) and represented African and White British ethnicities. Incomes ranged from under £20,000 to over £100,000, and their highest qualification ranged from NVQ or equivalent, to degree level.

The health professional group ($n = 7$) included a paediatric nurse practitioner, two sisters/charge nurses, an advanced practitioner, a paramedic, a general practitioner and a paediatric consultant. This group had between 10 and 34 years post qualification experience, five worked full time and two part time, all were White British, working in either the South West ($n = 5$) or the West Midlands ($n = 2$).

Co-design process. Two online workshops were held with parents and one with health professionals. The initial iPoorly app design and features were considered in the first workshop with parents. Feedback from this workshop was sent to the Cogniss team, and subsequently, a second iteration of the iPoorly app was reviewed at the second workshop with parents and the workshop with health professionals. Their feedback was used to revise and improve the app prior to launching the app on the app stores as a prototype for testing. An evaluation form was embedded in the app to gather proof of concept data. Gathering proof of concept data is essential to be able to evidence the potential value of any new intervention.

Workshops

Parents and health professionals were provided with access to the current version of the app on the no-code platform prior to each

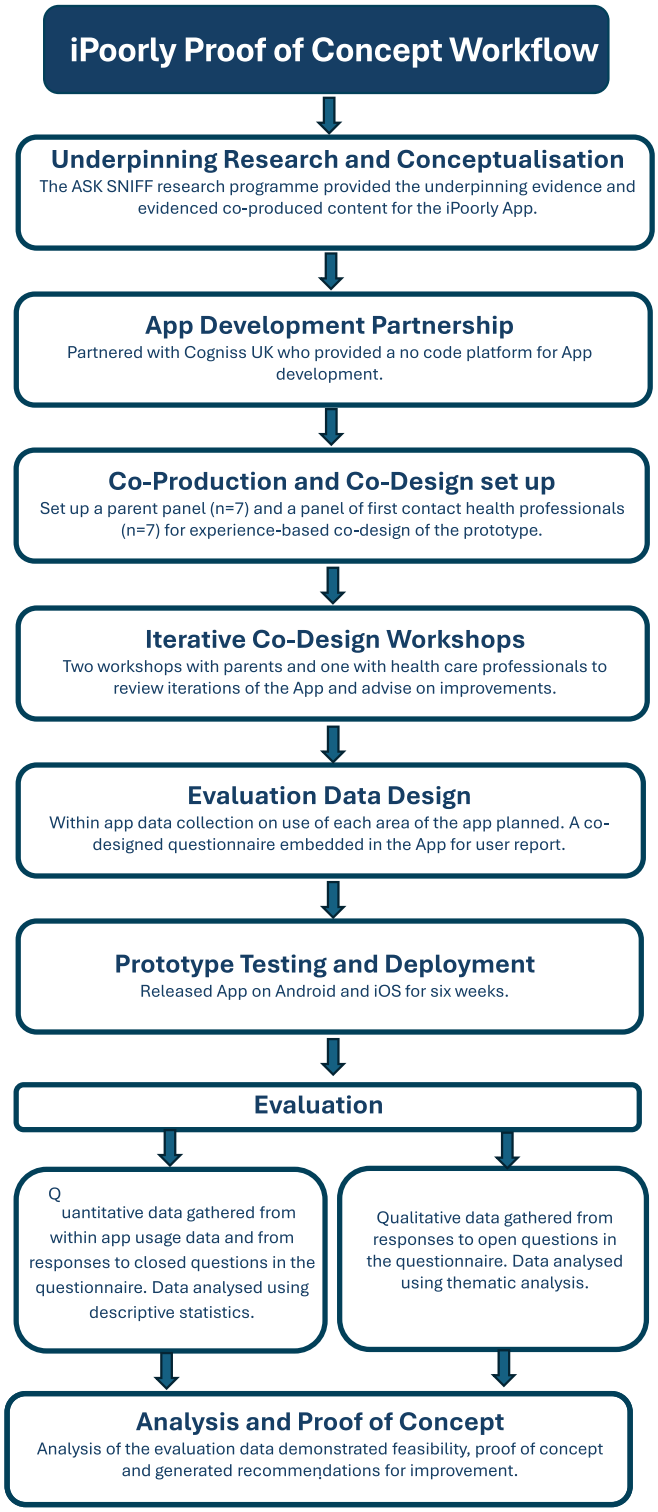

Fig. 1. iPoorly proof of concept workflow.

workshop to allow pre-session review. Each section of the app was demonstrated during each workshop to stimulate discussion on the strengths, weaknesses and areas for improvement.

Parents and health professionals provided input on content, aesthetics and usability. Both groups liked the "when to call 999" feature, and that the button itself linked directly to an emergency services call (999 is the UK emergency phone line). They also liked the use of traffic lights colour system aligned to symptom severity, information on *"what to look out for"*, hyperlinks to trusted websites including the use of NHS sources, and the diversity of content from audio to video and text.

Structure of the app

The landing page of the final prototype included a tab for when to call 999 at the top, with tabs for symptoms and general information on childhood illness below it. Tapping on When to call 999 took users to a list of symptoms for which they should call 999 with a button at the bottom which linked directly to the 999 service. Tapping on Symptoms took users to a list of children's ages up to five years. Choosing the age range that fitted their child then ensured that all the information which followed was appropriate for that age range. The next screen then presented a list of the six most common presenting symptoms of childhood illness. Each symptom set included separate tabs for information on how to assess that symptom in their child, how to look after a child with that symptom and why that symptom happens. The latter included hyperlinks to external relevant and reliable sources of information. The assessment content contained hyperlinks to short video clips of children with the relevant symptom. Fig. 2 shows screen shots of the first few screens in the app.

Evaluation strategy

An evaluation form was developed and included within the app to capture evaluation and proof of concept data (See Appendix 1). Data took two forms: within app data on the use of each area of content and data gathered using the evaluation form. The hyperlink to the latter form, created on Jisc surveys (https://app.onlinesurveys.jisc.ac.uk), was embedded in the front page of the app. This took the form of a questionnaire including an adapted System Usability Scale (SUS) (Brooke, 1996; Lewis, 2018) which is widely used for DHIs (Aronson et al., 2021; Meinert, Rahman, Potter, Lawrence, and Van Velthoven, 2020). We adapted the SUS following discussions with our parent panel who felt that the phraseology would be difficult for parents to understand. All questions were tested with our parent panel for comprehension, before including in the evaluation form in the app. We also added questions on ethnicity, age of youngest child and subject specific questions to gather data on understanding, confidence and impact on decision making whilst keeping the form short to maximise completions.

The app was live on both android and iOS app stores for 6 weeks between September and October 2024. In total 603 people downloaded the app and of these 60% completed the evaluation form. Analysis of the evaluation form data was guided by the key concepts from a modified Technology Assessment Model (mTAM) framework (Cheah, Mat Jusoh, Aung, Ab Ghani, and Mohd Amin Rebuan, 2023; Dias et al., 2022; Duong, Vu, and Ngo, 2023; Portz et al., 2019). These key concepts are: perceived usefulness (PU), perceived ease of use (PEoU), usage attitude (UA), usage intention (UI), and actual usage (AU) (Dias et al., 2022). These constructs, along with perceived trustworthiness (PT) which emerged as important during the preceding ASK SNIFF work, were used to facilitate analysis of the evaluation data. Quantitative data, within App usage data and numerical questionnaire responses, were analysed using descriptive statistics as there was no comparison group and the aim was to describe the data gathered.

Results - Proof of concept

Characteristics of the respondents

The sample was predominantly representative of white or white mixed ethnicities but not of non-white sectors of the community. The majority (n = 286/79%) of respondents reported their ethnicity as English/Welsh /Scottish/Northern Irish/British. The next biggest groups were 'White and Asian' (n = 20/6%), 'White and Black African' (n = 17/5%), 'White and Black Caribbean' (n = 8/2%) and any other White background (n = 16/4%). Non-white ethnicities made up the remainder of the sample (n = 14/4%). In comparison to Census 2021 data for England

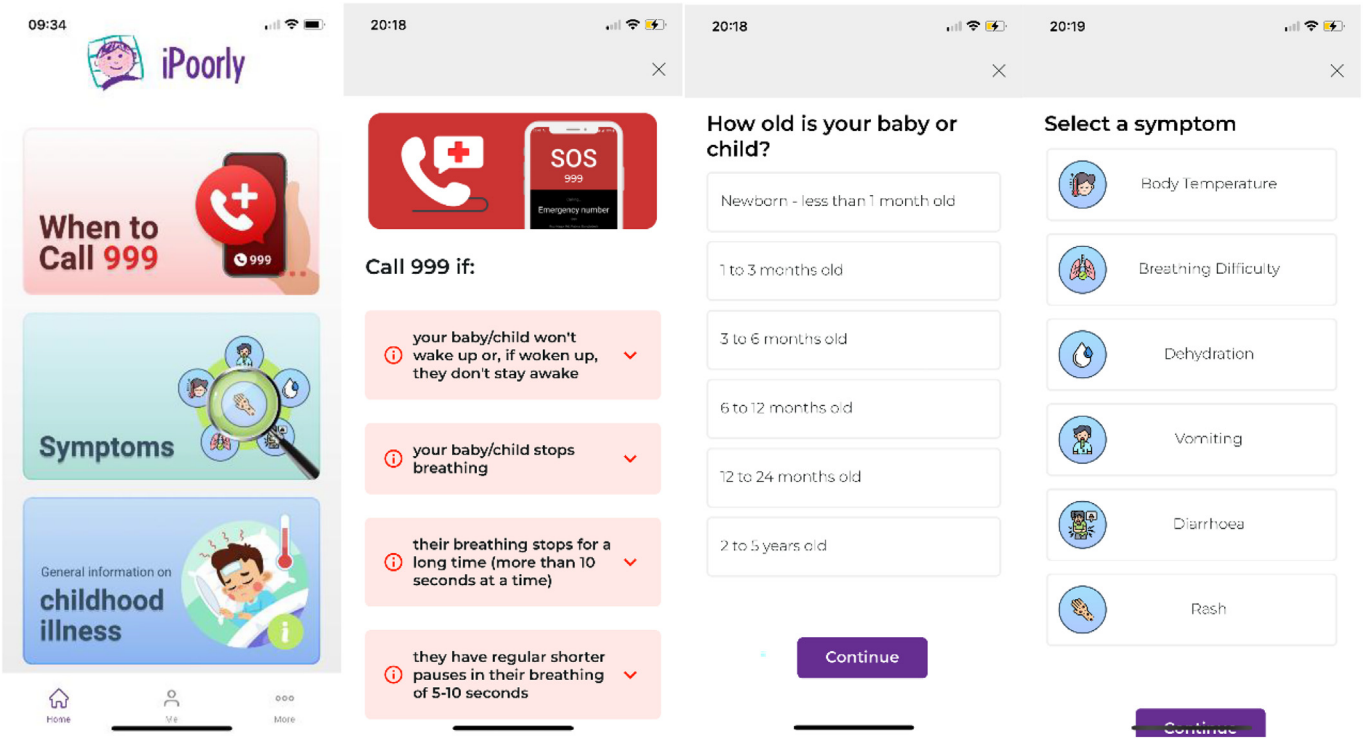

Fig. 2. Screenshots of the initial pages in the iPoorly app.

and Wales, this is a slightly higher percentage of white ethnicities (79% versus 74.4%) and white mixed ethnicities (13% versus 6.2%) and lower percentage of non-white ethnicities (4% versus 13.3%).

Responses on the age of their youngest child shows a diverse mix of ages from 1 to 6 months old to 5 years of age. Only one child was reported to be less than one month old. However, as we asked for the age of the youngest child and not the ages of all the children in the family; we do not know how many respondents had more than one child or were new parents.

Analysis of within app data

There were 2283 unique engagements recorded within the symptom checker. Body temperature was the most frequently used feature with 818 interactions. Recording body temperature in children up to one year of age accounted for all of the engagement, with children up to one month representing 86% of these interactions. Breathing difficulty was the second most commonly used feature with 503 interactions. Those with children up to 12 months represented 84.4% of these interactions. The remaining interactions were equally spread across the other symptoms. When the rash feature was used, 80.4% of reports where in children up to one year old. Children up to two years old dominated the dehydration feature representing 92% of interactions, and those 1to2 years old reporting diarrhoea accounted for 88.4% of engagement.

The event log outlined early patterns of behaviour across 18,788 interactions across 634 unique users. Engagement peaked from 12:00–15:00 with no noteworthy variation across the hours (mean interactions 1324.6 $\pm$ 320.8). The median number of interactions when on the app was nine. The analysis used a 'five minutes of inactivity' cut off to assume the end of a session. Although there was some variance, the median number of sessions across the deployment phase was one. The median duration of time per session was 62 s and the total app usage duration was a median of 1.4 mins. Two people had one action within the app and 116 people had two actions. This 118 may indicate people who logged on and exited the app without using it as intended. There were some outliers who used the app an unrealistic number of times skewing the result, hence the need to report the median.

Quantitative evaluation data

The SUS facilitated the capture of a range of data on the usability of the App (see Table 1). Aggregated positive ratings for the app ranged from 91% to 53% across all of the items in the SUS. The detail of the responses to each item can be seen in Table 1.

Perceived usefulness

Our subject specific questions enabled us to gather quantitative data on perceived usefulness, concerning the impact of the App on confidence in caring for their child when ill and understanding of symptoms of childhood illness. The overwhelming majority (313/362, 86%) reported that the app had improved their confidence in caring for their child when ill; only 14% said it had not. The majority (327/362, 90%) reported that the app had improved their understanding of the symptoms of childhood illness.

Usage intention and actual use

Two questions were included which focussed on ascertaining whether or not using the app influenced parents' decisions to seek health care for their child: one asking about an actual illness event (actual use (AU)) and the other asking about a hypothetical event (usage intention (UI)). We asked whether or not the app helped them to decide whether or not to seek help for a child who was ill at the time of using the app (AU) - the majority said it had (220/362, 61%). The negative responses here (39%) would have included those whose child was not ill at the time they were using the app. We also asked, hypothetically, if their child was not ill at the time of testing the app, if the app would help them decide whether or not to seek medical help for their child (UI). A higher majority, than for an actual illness, said it would (261/362,72%).

Table 1
Adapted SUS question responses.

System usability scale questions	Please rate your answers from 1 (strongly disagree) to 5 (strongly agree) (*n*/%)				
	1	2	3	4	5
I think I will use this App a lot	6/2%	19/5%	44/12%	212/59%	81/22%
I found the App too complicated	96/27%	168/46%	52/14%	22/6%	24/7%
I thought the App was easy to use	5/1%	11/3%	41/11%	199/55%	106/29%
I think that I need help to be able to use this App	144/40%	99/27%	27/7%	61/17%	31/9%
I found the content in this App were well connected with each other	7/2%	20/6%	69/19%	186/51%	80/22%
I think there is too much inconsistency in this App	76/21%	162/45%	79/22%	30/8%	15/4%
I think most people would learn to use this App very quickly	2/1%	7/2%	24/7%	184/51%	145/40%
I found the App very difficult to use	132/36%	118/33%	38/10%	35/10%	39/11%
I felt very confident using the App	1/0%	5/1%	41/11%	184/51%	131/36%
I needed to learn a lot before I could use this App	131/36%	98/27%	38/10%	49/14%	46/13%

Qualitative evaluation data

Each of the last two questions were followed by an option to provide further information explaining their responses. This open text data was analysed using a modified Technology Assessment Model (mTAM) framework. The small numbers of responses in each category reflects the nature of optional requests to add free text data.

Perceived ease of use (PEU)

Respondents reported that the app had a clear layout, was easy to use ($n = 10$) and navigate ($n = 3$) to find advice, and easier than via Google search engine. Information was helpful ($n = 2$), clear and easy to understand ($n = 6$), not overloaded with words and different options ($n = 2$). Conversely, two respondents stated that it was wordy and difficult to take in when a child is unwell and you are worried.

App functionality

There were some functionality problems reported including the app crashing (in the Vomiting section) ($n = 2$) and a broken link in dehydration. The lack of a back button was noted ($n = 6$), hidden information identified ($n = 3$) where sentences were incomplete, and dropdown arrows with no content. The requirement to scroll down beyond the bottom of the screen was also disliked, as was the requirement to press continue at the bottom of each screen as it added too many clicks.

Perceived usefulness

Overall usefulness of the app

Responses in the open text boxes within the evaluation form were positive about the usefulness of the app. Respondents stated that they liked the access to accurate, trusted and reliable information ($n = 7$), enabling parents to learn about symptoms of childhood illness ($n = 7$) compared to normal ($n = 7$), particularly for first time parents ($n = 4$). The app was reported to have helped parents assess, monitor and care for their children and their symptoms ($n = 16$). Many respondents reported that parents valued the guidance on "*what to look out for*", especially "red flag" indicators of serious illness ($n = 18$). The commonest feedback ($n = 93$) was that the app helped them to know when to seek medical help or call 999. The 'When to call 999' page was reported to be useful to scan though and respondents liked the ability to call 999 from the app, adding the suggestion that NHS 111 could also be added ($n = 3$).

One respondent felt that further guidance was needed on when to seek help: 'Eg under temperature. If their temp is not returning to normal after *** consider contact GP/NHS24 etc'. (NHS24 is the Scottish equivalent to NHS 111). This information was included in the body temperature symptom set suggesting that it needs to be more visible.

The app was reported to be reassuring ($n = 8$), consequently reducing anxiety (*'the app would give me peace of mind')* and increasing parents' confidence in assessing and caring for their child ($n = 6$) and in their decision making concerning when to seek help ($n = 93$), reflecting SUS ratings. Further comments were made that it would also give them confidence to take action and seek help from a health professionals or call 999 ($n = 10$).

It was reported to provide reassurance that the symptoms were manageable at home. One respondent also commented that:

> *"It would validate my feelings/understandings on my concerns about my child.'I am a new mum and this is easy to use and helps me realise I am not over reacting".*

This need to validate their concerns was also reflected in expression of concern about wasting professional's time ($n = 4$). One respondent commented that the app helped them '*to get the right care'*. There were indications that the App could reduce the need to use health services; one person commenting that it helped to prevent a hospital admission and others commenting that it could help to reduce the need for a GP appointment or calling NHS 111.

The app was reported to be better than, or a good alternative to, NHS 111 as it removed the need to wait for a response and the information is always accessible:

> 'I think the app is helpful. It is a similar experience to dialing 111 but you don't have to wait on hold so I suppose it is better than 111 as parents can access info any time.'

Access to external information was also reported to be helpful as it removed the need to Google making it better than searching for information online ($n = 5$):

> *'having the normal breathing rates by age in the app saves my usual 1am google search.'*

Respondents liked the focus on symptoms rather than diagnoses and in future versions of the app respondents would like to see more photos and videos of symptoms. They would also like to be able to select multiple symptoms ($n = 4$) and have information on a wider range of symptoms. Content on older children was requested ($n = 3$) and the option to create child profiles ($n = 2$) which could also include the child's height and weight. Some respondents did also mention other Apps: Handi ($n = 5$), Lullaby Trust ($n = 2$), Healthier Together ($n = 1$), When should I worry ($n = 1$) and British Red Cross ($n = 1$).

Perceived usefulness of specific parts of the app

Presentation of information in the app

Traffic lights colours (red, amber, green) were used throughout the app to indicate severity of symptoms. Ten respondents commented that this system helped them to *'determine at which point to seek help and type of help'*. Symptoms in the 'red box', sometimes referred to as

'*red flag*' symptoms, enabled respondents to *'instantly to see if it is a serious concern'* and know what to *'confidently focus on these when calling 111 as makes it clear these are what healthcare professionals would be most interested in'*. In this way the App provided parents with the words to use to explain children's symptoms to healthcare professionals. Although some respondents ($n = 4$) clearly indicated that they had understood the meaning of the colours correctly (*'green for self-care, amber for contacting a healthcare professional, and red for immediate medical attention'*), two respondents felt that each symptom set should clearly indicate which part of the health service was needed at each symptom level.

Videos were included in some of the symptoms showing young children with the symptom concerned or how to do things (e.g. counting breathing rate). These were felt to be helpful ($n = 4$) E.g.

> *'The videos of work of breathing helped me to assess whether further advice was needed for my child with a cough'.*

Symptom content

Body temperature ($n = 11$): Content on normal and abnormal ranges of body temperature, when to seek help and when to give paracetamol were reported to be reassuring (*'this app has calmed me'*) and assisted with decisions concerning whether or not to seek help:

> *'Great to see the normal ranges of temperature. There is a lot of conflicting information out on the internet. Very clear reassuring.'*

One respondent commented that they would like more explicit information on when to seek help:

> *'temperature ranges are presented using traffic lights, but it doesn't explicitly state that red means seek help'.*

Breathing difficulties ($n = 10$): Content on age specific breathing rates, work of breathing, including the videos, was reported to assist in decision making about seeking help for children with a cough or a '*stuffy nose*'. However, others commented that there was not enough information on coughing, sneezing or runny noses.

Dehydration ($n = 2$): These comments, specifically related to dehydration, indicated that the app was helpful in determining whether or not their child was dehydrated:

> *'I was concerned about dehydration because my daughter doesn't drink much but the information showed she is fine, there was no need to seek help.'*

Vomiting ($n = 7$): Two respondents stated that the app helped them to differentiate between vomiting and positing – '*Vomiting a lot but learnt it wasn't that much and was just positing*', and two others stated that the app reassured them that they did not need to seek medical help. Unfortunately, two other respondents reported that the app crashed in this section of the content.

Diarrhoea ($n = 4$): Only a few comments were received for this symptom including that the inclusion of the Bristol stool chart and the information on level of seriousness of this symptom helpful. One respondent commented that while this information is helpful, '*the app can't capture the nuances of concern*'.

Rash ($n = 14$): Content in the app on rashes was reported to assist with help seeking decision making, differentiation between blanching and non-blanching rashes, identifying serious/non-serious rashes and understanding the cause of rashes.

> *'My child had a small rash come up and the app helped me decide if I needed to do something about it or whether it was okay to leave but explained what to keep an eye out for if anything did change.'*

Some respondents liked the link to the NHS rashes webpage whilst another respondent would prefer the pictures of rashes to be included in the app.

Perceived trustworthiness

Seven parents commented on the trustworthiness of the app, mostly positively ($n = 5$) as a trusted resource which they would share with other parents. One parent explained that they wouldn't trust it unless it was endorsed by the NHS or healthcare Trusts and another commented that the inability to select multiple symptoms *'wouldn't make me trust the advice received via the app'*.

Attitudes towards using eHealth (usage attitude (UA))

Parents comments ($n = 19$) revealed their attitudes towards using eHealth interventions such as this app. Responses indicated the acceptability of using apps as an alternative to *"111 and/or your GP when you're looking for general advice on symptoms"* or for quick access to information, to validate their need to seek help from a medical professional, or to find out which part of the health service they should use for that level of illness – *"Can get quick answers as to what's a 999 call and what can be a GP/Pharmacy etc"*.

Discussion

The data gathered clearly demonstrates proof of concept as it shows that providing information on symptoms of acute childhood illness in a co-developed mobile App can positively influence parents' ability to care for a sick child at home. The data shows that the App can enhance parents' self-reported knowledge and understanding of symptoms of acute illness, indicating that it improves parents' health literacy, reassuring parents about the right course of action and reducing anxiety about their child's illness. Providing anytime access to the information was '*better than 111*' as there was no waiting '*on hold*', whilst also circumventing the need to search for information on google as information was easier to find. The earlier underpinning research (Neill et al., 2014; Neill, Jones, Lakhanpaul, Roland, and Thompson, 2016) shows that 'googling' often leaves parents feeling confused about what information to trust and/or increases anxiety about potential diagnoses. Feedback on iPoorly indicates that parents also valued the inclusion of hyperlinks to trusts online information, which was identified by app users as a missing element in Verzantvoort, Teunis, Verheij, and Van Der Velden's (2018) 'Should I see a doctor' app in the Netherlands.

The evaluation confirmed prior findings from the ASK SNIFF research programme (Neill et al., 2024) and the recent review (Carey et al., 2025) that simple language avoiding medical jargon was valued, as was the use of traffic lights colours and being able to see videos of symptoms in real children. Being able to assimilate new information quickly is particularly important in the moment of caring for an acutely ill child.

The iPoorly app was reported to both reassure parents about non-serious symptoms whilst also enabling them to identify symptoms that required medical assessment. Participants in van de Maat et al.'s (2018) study also positively evaluated information on the severity of symptoms. Parents and professionals can miss signs of serious illness in children (Carter et al., 2020; Neill et al., 2022). There is consequently a role for apps like this in educating parents *and* health professionals such as nurses in first contact services such as general practice, urgent and emergency care.

When seeking help, parents are further supported by the app as it provides them with the words to use to describe their child's symptoms to a nurse or a doctor, something that earlier research has found that parents can find difficult when in the stressful events of caring for a sick child (Neill et al., 2022). Our parent panel has consistently stated that they want an app which they can use to broker relationships with their child's health professionals. This ability to empower parents with this information demonstrates that a co-designed and co-developed mobile app, such as this, can also reduce health service use at low levels of illness or facilitate timely access to health care for more serious illness.

Limitations

Funding limited the time the app was available on the app stores to six weeks. Given the timeframe the uptake was high. However, the majority of users were white or white mixed ethnicity. Consequently, no conclusions can be drawn about the usefulness of the App for other ethnic groups or for those from underrepresented communities. This should be the focus of future work. Although the evaluation was overwhelming positive, it has to be acknowledged that users were self-selecting to trial the app, consequently they were more likely to be positively inclined to use DHIs. Future app development will also need to be designed with parents who are less digitally confident to ensure their needs are also met.

This was the first prototype of this co-designed and co-developed app, consequently it is not surprising that there were a few technical problems, largely resulting from the limitations of the platform used to build it. The choice of digital developers and platform was also limited by the funding available. The functionality of the app was reported to have a direct impact on users trust in the content, making it essential to carefully test apps in future to correct any technical issues. Respondents also commented that NHS endorsement would enhance trust in the app.

Areas for further development of the app

A number of helpful suggestions were made by respondents such as adding in the ability to call NHS111/NHS24 (UK health helplines) directly from the app, increasing the number of symptoms, adding content for older children and enabling combinations of symptoms to be searched. Increasing the clarity of statements concerning what to do in response to each level of symptom severity and combination of symptoms would also enhance the app.

The project team already plan to add to the photos and videos in the app and to add the option to create profiles for individual symptoms. Providing this option was also identified as a suggested improvement in Verzantvoort et al.'s (2018) app evaluation along with the ability to add photos and detailed information about their child's symptoms. We would also like to provide a diary function including the ability to capture images and video on camera and the option to forward information to others, including health professionals. We feel that the app would also be enhanced by including geolocation enabling the identification of the nearest health services. In the future, apps may also be synchronised with wearables or phone cameras capable of gathering real time vital signs such as pulse, oxygen saturation, learning the individual's normal parameters and alerting when these are exceeded.

Implications for practice

This is the first UK app to publish evaluation data gathered from end users. Consequently, it is best placed for adoption within the NHS in the UK. Systems for the dissemination and distribution of the app need to be co-developed with parents and health professionals. Nurses can play a pivotal role in introducing parents to the app at every contact young children have with health services. Introducing the app during consultations will empower parents by providing them with ease of access to information to help them to care for their acutely-ill children and know when to seek help for that illness and future such illnesses. Using the app in this way can facilitate nurses communication with parents, provide consistent reliable information and vicarious learning opportunities for nurses and other health professionals.

Further research

Research is now needed to establish the most effective methods for disseminating information about the app, to explore the impact of the iPoorly app on parents' use of health services and on the quality of their interactions with nurses and other health professionals. This research needs to include parents from under-represented and underserved communities where the health needs of children are highest, nurses and other health professionals working in all settings providing care to acutely-ill children. Research is also needed to understand the optimal configuration of videos of symptoms to maximise parent and professional learning about symptoms of childhood illness.

Conclusion

The most powerful findings are that providing parents with easy access to information on symptoms of childhood illness increases knowledge, understanding and confidence in both caring for, and seeking help for, a sick child. These findings suggest that the app has the potential to both reduce health service use for minor illness and facilitate help seeking for more serious illness. Findings clearly demonstrate proof of concept for this co-developed prototype app and the underpinning iterative process of development. The data gathered has also informed the development of a plan for the next version of the app and its future potential development. In our digital age, mHealth apps such as these can be a powerful adjunct to information resources nurses can provide for parents.

CRediT authorship contribution statement

Sarah Neill: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Amy Rathbone:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Data curation. **John Downey:** Writing – review & editing, Writing – original draft, Formal analysis. **Monica Lakhanpaul:** Writing – review & editing, Conceptualization. **Damian Roland:** Writing – review & editing, Conceptualization. **Matt Carey:** Writing – review & editing, Writing – original draft, Formal analysis.

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Declaration of competing interest

None of the authors have any conflicts of interest to declare.

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Appendix A: Feedback questionnaire

iPoorly: child symptom checker app

Feedback form

Please help us improve this App by answering the following questions.

System usability scale questions	Please rate your answers from 1 (strongly disagree) to 5 (strongly agree) 1	2	3	4	5
1. I think I will use this App a lot					
2. I found the App too complicated					
3. I thought the App was easy to use					
4. I think that I need help to be able to use this App					
5. I found the content in this App were well connected with each other					
6. I think there is too much inconsistency in this App					
7. I think most people would learn to use this App very quickly					
8. I found the App very difficult to use					
9. I felt very confident using the App					
10. I needed to learn a lot before I could use this App					

iPoorly App specific questions

Has the App improved your confidence in caring for your child when they are ill? Yes/No
Has the App improved your understanding of the symptoms of childhood illness? Yes/No
If your child is ill, did the App help you to decide whether or not to seek medical help for your child? Yes/No.
If Yes, how? (optional)
If No, why not? (optional)
If your child is not ill, do you think that having 'the App' would help you to decide whether or not to seek medical help for your child? Yes/No
If yes, how? (optional)
If No, why not? (optional)

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