

## RESEARCH LETTER

# A virtual management approach to infant egg allergy developed in response to pandemic-imposed restrictions

Egg allergy is the most common food allergy of childhood,<sup>1</sup> but it is now well established that most egg allergic infants can tolerate extensively heated egg, baked in a wheat matrix. Furthermore, ingestion of baked egg has been shown to reduce skin prick test (SPT) wheal diameter to egg white and to be associated with an increase in IgG4 antibody levels to egg proteins.<sup>2</sup> Egg allergy is also an independent risk factor for the development of peanut allergy.<sup>3</sup> Introduction of peanut to all infants as soon as weaning begins is now universally accepted as critical to peanut allergy prevention.<sup>4</sup> However, infants with egg allergy and/or moderate-to-severe eczema may already be sensitized to peanut, and thus, SPT prior to introduction should be considered. Prior to the restrictions imposed by the COVID-19 pandemic, our allergy department provided a face-to-face evaluation for all infants referred with a history consistent with IgE-mediated egg allergy. The evaluation included SPT to egg and peanut (unless already introduced). Advice (verbal and written) on gradual introduction of baked egg was subsequently provided, and those infants with negative SPT to peanut were candidates for immediate home introduction. On 16 March 2020, in response to recommendations by the Irish National Public Health Emergency Team (NPHE) for COVID-19, all face-to-face hospital clinic visits were cancelled. With no established end date for the lockdown, a new management approach for the care of egg allergic infants was urgently required, in line with international recommendations.<sup>5</sup> We reflected on the necessity and evidence base for elements of our former face-to-face clinic. SPT does not predict tolerance to baked egg,<sup>6</sup> and our previous data had shown that most infants tolerate baked egg.<sup>7</sup> Thus, foregoing this test was not considered as increasing risk. With respect to SPT prior to peanut introduction, we concluded that the benefit of introduction for those with mild-to-moderate eczema had to be balanced against the risk of delay due to lack of available testing. We initiated telephone clinics (no access to secure video facilities). We developed a clinical proforma for recording key information to inform a shared decision for or against home introduction of baked egg/peanut without prior face-to-face evaluation or allergy testing. Eczema severity was assessed using the Nottingham Eczema Severity Scale (NESS).<sup>8</sup> Parents were asked to list the overall distribution of eczema. Home introduction of peanut was only to be advised for infants whose score indicated mild eczema. Introduction of egg in our service is guided by the Irish Food Allergy network (IFAN) egg ladder.<sup>9</sup> We have previously shown that this is a safe and effective model.<sup>7</sup>

This report is a retrospective review of all egg allergic infants that were managed by this new model. Our primary outcome was the successful introduction of baked egg into infants' diets within 4 weeks of first phone contact. Our secondary outcome was the successful introduction of peanut. The development of the new service was pandemic mandated and thus not subject to institutional review board (IRB) approval. The retrospective analysis of the patient records was approved by the Ethics (Medical Research Committee, CHI at Crumlin (ref: GEN/820/20).

All infants who had been referred, with a history of immediate reaction to egg, in the previous month or during lockdown were included in the initial telephone evaluation. Symptoms of the reaction were recorded. On the completion of the evaluation, the doctor determined the appropriate management plan with regard to introduction of both baked egg and peanut, based on answers collected. Any infants presenting with symptoms suggestive of anaphylaxis (persistent cough, wheeze, stridor, floppiness) or had received i/m adrenaline in the treatment of their reaction were excluded from home introduction of baked egg.<sup>10</sup> All other infants were considered candidates for home introduction of baked egg. Infants, whose NESS score was indicative of mild eczema, were to immediately have peanut introduced into their diets in the home setting. In contrast, in the case of infants, whose scores were suggestive of moderate-to-severe eczema, parents were advised against initiating home introduction before allergy testing became available again.<sup>11</sup> All families were sent a written letter summarizing the advice provided during the telephone clinic with additional written information, on home introduction of baked egg and peanut, if appropriate. Information included a copy of the Irish Food Allergy Network (IFAN) egg ladder, details of possible signs and symptoms that might be observed and indications to seek emergency support. They were all contacted 4 weeks later to ensure all information had been received, to determine their progress and to record any adverse reactions.

Between 31st March and the 28th April 2020, a total 23 infants, presenting with egg allergy were identified from referral letters; 22 were contactable by phone. 18 reactions to egg occurred on first exposure. The infants' demographics are shown in Table 1. The most common reported reaction was mild-to-moderate cutaneous signs, usually self-resolving. Only one patient experienced respiratory compromise requiring administration of IM adrenaline. There was no parentally reported or medically confirmed cardiovascular compromise (Table 2). The infant who experienced anaphylaxis was

TABLE 1 Population characteristics

Gender	Male n = 10 Female n = 12
Average age at time of reaction (months)	7.5 (range 5.5-12)
Average age at time of initial consultation (months)	10 (range 7-18)
Type egg ingested at time of reaction	1 pancake 6 hard boiled 1 soft boiled 14 scrambled
Time from ingestion to reaction (minutes)	33 (range 0-150)
Nottingham Eczema Severity Score	11 Mild 2 Moderate 4 Severe 5 n/a
Other reported food allergies	2 Cow's milk allergy 3 Salmon 1 Tomato
Average SPT egg (mm)	4 (0-7)
Average SPT peanut (mm)	2 (0-7)

excluded from home introduction of baked egg. The remaining 21 were considered suitable for home introduction of egg using the IFAN Egg Ladder.

Follow-up phone calls were performed between 5th and 25th May 2020, 4 weeks after first contact. 16/21(76%) had successfully introduced baked egg without incident. Out of the remaining 5, 4 parents reported intending to introduce egg but had been delayed due to illness (1), eczema flares (2) and problems obtaining antihistamine due to 'lockdown' (1). No parents had difficulty accessing baked egg products despite the lockdown. 1 parent reported not

introducing egg by the time of follow-up but did not give a reason and subsequently did not attend for skin prick testing.

4 infants were already eating peanut at the initial consultation. 12/22(55%) families were advised to introduce peanut at home postconsultation. 6/22(27%) were advised to wait until SPT was performed; 4 due to a NESS score > 12 suggesting severe eczema, 1 because of a strong family history of food allergy creating parental anxiety and 1 because of multiple confirmed food allergies with moderate eczema score. At the time of their follow-up phone call, 5 of 12 (42%) had introduced peanut, 1 had attempted to introduce peanut but stated the infant would not eat it, and 6 parents reported anxiety around introduction and a preference to establish the infant on the IFAN egg ladder first (Figure 1).

Of 18 patients subsequently attended for skin prick testing when clinics reopened on 15th May. 3 patients testing negative to egg. The remainder showed egg SPT between 3 mm and 7 × 4 mm. 2 patients were already eating hard-boiled egg at the time of their 4-week follow-up phone call so were felt not to require SPT to egg.

Of 11 infants had peanut SPT, and 9 were negative. 2 patients with positive peanut SPT underwent hospital-based food challenge: 1 passed and 1 failed. 2 patients were lost to follow up after the 4-week follow-up phone call and did not attend for SPT.

Of 76% of families within this cohort successfully introduced baked egg to their child's diet during the most restricted period of the Irish COVID lockdown, within 4 weeks of a simple phone consultation with a paediatric allergist. A further 18% reported feeling confident to introduce but were delayed by perceived contraindications (eczema, illness). None of the families expressed concern regarding access to emergency departments (ED) as a deterrent to introduction of baked egg. This outcome questions the need for the traditional approach of face-to-face consultations within hospital settings for infants with typical mild egg allergy, before initiating interventions. Face-to-face consultations mean that parents incur indirect costs due to travel, parking and time off work, in addition to the inevitable and possibly critical delay due

TABLE 2 Symptoms during first allergic reaction to egg and treatment required

	N (n = 22)	%
<i>Symptoms</i>		
Perioral rash	8	36
Generalized Urticaria	7	32
Angioedema	2 (lip swelling)	9
Immediate vomiting	6	27
Delayed Vomiting	2	9
Upper Respiratory	3	14
Lower Respiratory symptoms	1 (wheeze)	5
<i>Treatment received</i>		
Attended A&E	4	18
Received antihistamine	7	32
Other medications	2 steroids 1 IM adrenaline + nebulized salbutamol	14
Resolved without treatment	14	64

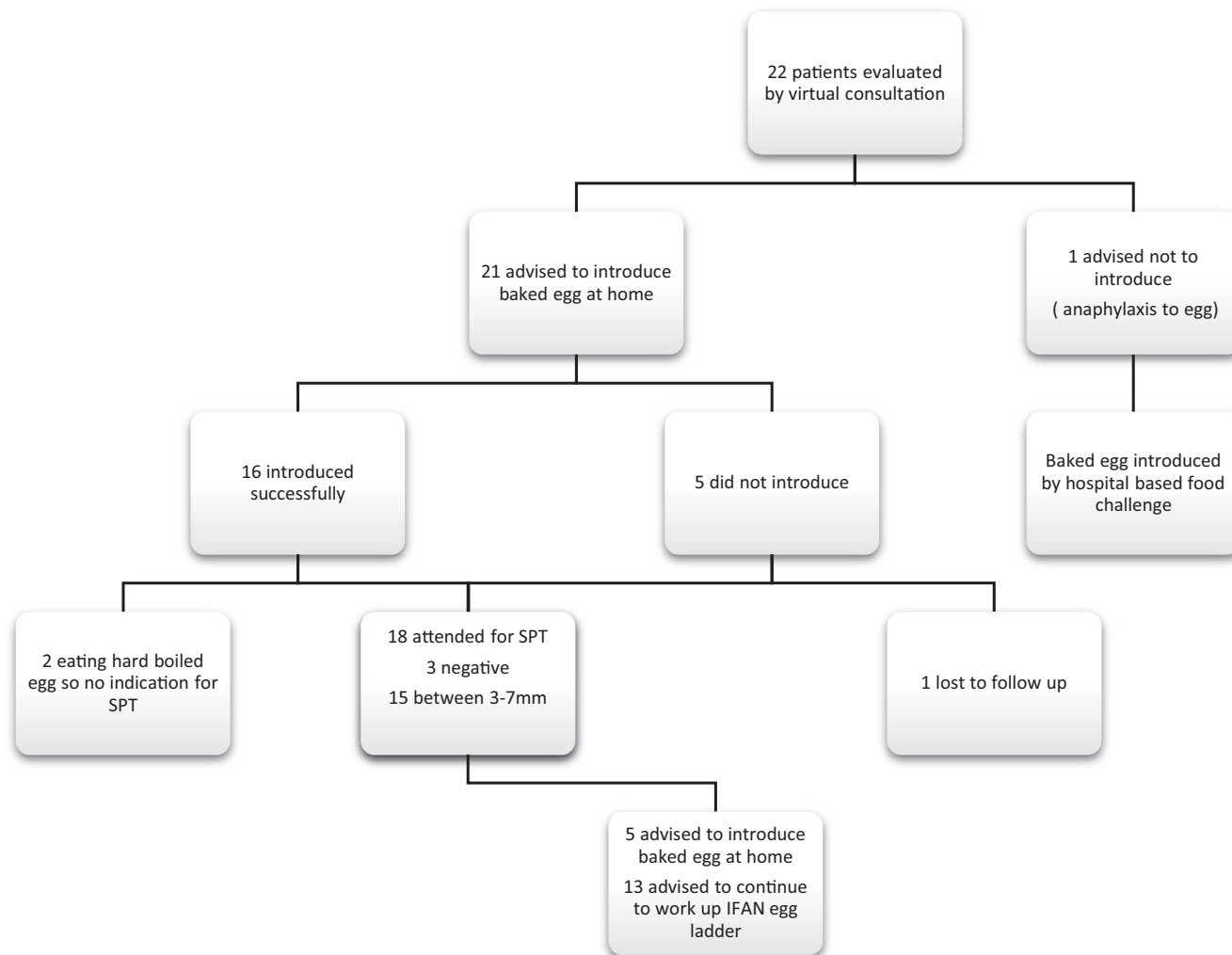


FIGURE 1 Flow diagram of baked egg introduction

to scheduling. Waiting lists for allergy clinics across Ireland and UK continue to grow. It is imperative that available clinic slots are appropriately assigned.

Unfortunately, only just over 40% of those advised to introduce peanut to their child's diet did so. Fortunately, the delay did not significantly hamper peanut allergy prevention as all, but 1 infant went on to have peanut introduced post skin prick test/food challenge. The study was not designed to examine whether parents' reluctance was due to the lack of reassuring negative diagnostic tests or to their fear of attending ED during the COVID surge. However, fear of needing to attend ED is likely to have played a role. It was reported that between March and April overall attendances to ED fell by 30% across Ireland.<sup>12</sup> In this study, the telephone consultations were carried out by a senior trainee under the supervision of a consultant allergist using a standardized proforma. It is reasonable to consider that this model could be adapted to use safely outside of a tertiary allergy centre by secondary care paediatricians and general practitioners.

As restrictions to hospitals and diagnostic tests are being restored, appropriate alternative approaches to successful home

peanut introduction need to be sought. Chan et al recently published a model for virtually supported home introduction of peanut using a video connection and prior prescribing of adrenaline autoinjectors. It is likely that, going forward, different models of support (detailed written guidelines, 24-hour hotlines, video supports) stratified against level of risk, will be required.

Eczema severity is positively associated with higher levels of peanut sensitization. In this study, the high level of negative peanut skin tests subsequently recorded suggests that use of the NESS score by phone may have overestimated eczema severity. Ideally, virtual consultations with video support would enhance evaluation.

We believe this pandemic-driven adaptation of clinical practice for egg allergic infants is safe and successful and could be utilized in the future even as COVID restrictions ease, to ensure prompt management of new referrals of egg allergy without compromising outpatient clinic access. Peanut introduction was less successful, despite eventual testing being negative in more than 80% of 'peanut-suitable' children, and thus, home introduction of peanut remains a challenge that seems more related to parental anxiety than to immunological risk.

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## CONFLICT OF INTEREST

The authors declare no conflict of interests.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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