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ORIGINAL ARTICLE

Prevalence and stability of blood–injection–injury phobia in childhood—A prospective community study in Norway

Ingrid Berg Johnsen[1,2] | Lars Wichstrøm[3,4] | Göran Dahllöf[1,2]

[1]Division of Orthodontics and Pediatric Dentistry, Department of Dental Medicine, Karolinska Institutet, Stockholm, Sweden

[2]Center for Oral Health Services and Research, Mid-Norway (TkMidt), Trondheim, Norway

[3]Department of Psychology, Norwegian University of Science and Technology, Trondheim, Norway

[4]Department of Child and Adolescent Psychiatry, St Olavs Hospital, Trondheim, Norway

Correspondence
Göran Dahllöf, Department of Dental Medicine, Karolinska Institutet, POB 4064, SE-141 04 Huddinge, Sweden.
Email: goran.dahllof@ki.se

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Abstract

Aim: An individual with a blood–injection–injury (BII) phobia often avoids exposure to triggers, such as blood tests and clinic appointments, leading to potentially serious health complications. This population-based study examined the prevalence, stability and course of BII phobia in children and adolescents.

Methods: The data came from the Trondheim Early Secure Study, conducted from 2007 to 2018. All children born in Trondheim, Norway, in 2003 and 2004 were invited to attend. Clinical interviews were conducted by trained personnel to assess BII phobia in 1042 children (51% female) every 2 years from 4 to 14 years of age. Latent growth curves and logistic regression analyses were used in the data analysis.

Results: Just under 20% of the cohort experienced a BII phobia at least once, with no significant sex differences. The prevalence of BII phobias increased from 3% at 4 years of age and peaked at about 8% at 10 years of age, before levelling off. The two-year stability increased as 12–14 years of age approached.

Conclusion: The prevalence of BII was affected by age, but not sex. Early BII phobias often recede with time, but children may need treatment if they persist from 8 years of age.

KEYWORDS
anxiety, avoidance, fear of needles, specific phobias, triggers

1 | INTRODUCTION

A blood–injection–injury (BII) phobia is a type of specific phobia characterised by excessive, irrational fear in response to the sight of blood, injection, or injury, or in anticipation of exposure to blood, injection, or injury. An individual with a BII phobia will often take steps to actively avoid exposure to triggers. This may lead to serious health complications because they delay or avoid appointments, blood tests and necessary self-injections.[1,2] Being afraid of injections was a risk factor for vaccine hesitancy in adults during pandemics, such as COVID-19.[3]

According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, a specific phobia is characterised by a marked and persistent fear that is excessive or unreasonable. Phobias relate to the presence or anticipation of a specific object or situation. Exposure to the phobic stimulus almost invariably provokes an immediate anxiety response. Furthermore, the individual recognises that the fear is excessive or unreasonable and

Abbreviations: AIC, Akaike's information criterion; BII, blood–injection–injury; CI, confidence interval; OR, odds ratio; SABIC, sample size–adjusted Bayesian information criterion; SDQ, Strengths and Difficulties Questionnaire.

either avoids the phobic situation or endures it with intense anxiety or distress. This greatly interferes with normal routines, academic and social activities and relationships. For individuals under the age of 18 years, a duration of at least 6 months is required for diagnosis.[4]

Essau et al.[5] found a 3.5% prevalence of specific phobia in German adolescents. Burstein et al.[6] reported that 15.1% of American adolescents aged 13–18 years met the criteria for a specific phobia sometime within their lifetime. Of the subtypes of specific phobia, animal and natural environment phobia were the most common, each with a frequency of 1.1%; while 0.9% experienced situational phobia; and 0.8% BII.[5] Prevalence estimates of BII for children and adolescents, however, are uncertain, varying between 0.8% and 9.1%,[5,6] likely depending on sample and measurement. Retrospective reports from adults with a BII phobia indicate childhood onset and high stability of diagnosis,[7–9] however, a range of biases can affect retrospectively collected data. No longitudinal studies on the course of BII phobia in a population-based sample of children have been published, to our knowledge.

Developing effective measures to manage, prevent and treat paediatric BII phobia is essential, especially if the phobia is prevalent, emerges early in life and continues, as indicated by previous research. Given this gap in our knowledge, we investigated the prevalence, stability and course of BII phobia from 4 to 14 years of age in a Norwegian community sample with clinical interviews every 2 years.

Our hypotheses were that the prevalence of BII phobia would be highest at 4 years of age and have high stability.

Key notes

- A blood–injection–injury (BII) phobia can cause a person to avoid exposure to triggers, leading to potentially serious health complications.
- This population-based study found that just under 20% of 1042 children experienced BII phobia at least once.
- The prevalence of BII phobias increased from 3% at 4 years of age and peaked at about 8% at 10 years of age, before stabilising at 6–8% at 12–14 years of age.

2 | METHODS

2.1 | Study design

The data were collected from the Trondheim Early Secure Study,[10] a comprehensive longitudinal community cohort study of mental health problems in children.

2.2 | Setting and participants

All children who were born in 2003 and 2004 and whose parents were living in Trondheim, Norway, were invited to participate in the study as described by Steinsbekk and Wichstrøm (2018).[10] The Strengths and Difficulties Questionnaire (SDQ) for children aged 4–16 years was mailed to the children's homes, along with the study invitation. The SDQ is a screening assessment for emotional and behavioural problems.[11] Parents returned the completed questionnaire when they attended the Well Child Clinic for the children's 4-year routine health checks in 2007 and 2008. The nurse informed the parents about the study using procedures approved by the Regional Committee for Medical and Health Research Ethics and obtained written consent for participation.

Figure 1 is a flowchart of the recruitment and follow-up process. We asked 3016 families to take part and 2475 (82.1%) agreed. To increase the statistical power of our study, children with emotional or behavioural problems were oversampled. Participants were allocated to four strata according to their SDQ scores: 0–4, 5–8, 9–11 and 12–40. A subsample of 1250 families was then randomly selected from those who had consented to participate. The probability of being selected increased with higher SDQ scores and were 0.37, 0.48, 0.70 and 0.89, respectively. The analyses were adjusted for this oversampling to produce corrected population estimates. This meant that 1007 of the subsample of 1250 children were successfully enrolled at baseline. Their mean age was 4.7 years ±0.30 and 50.9% were girls. The mothers and fathers were mainly of Norwegian origin (93.0% and 91.0%, respectively) or came from other European countries, the USA, Canada, Australia, or New Zealand (2.7% and 3.2%, respectively). The drop-out rate after consent did not differ by SDQ score or sex. Retesting occurred at 6, 8, 10, 12 and 14 years and the means ages were 6.7 ± 0.17, 8.8 ± 0.24, 10.5 ± 0.15, 12.5 ± 0.15 and 14.4 ± 0.16, respectively. We found that 35 families who were selected to participate, but were not interviewed during the baseline data collection, participated in later waves. The analytical sample was 1042 families with at least one wave of data. Boys were more likely than girls to drop out of the study at 10 years of age (OR 1.38, 95% CI 1.06–1.81) and 14 years of age (OR 1.40, 95% CI 1.09–1.81). Those with BII phobias as compared to those without BII phobias at the age of eight were less likely to drop out at the age of 12 (OR 0.39, 95% CI 0.16–0.93) and 14 (OR 0.41, 95% CI 0.19–0.87).

Children were first assessed in when they were 4 years old, and they were followed up biennially until age 14. The child and one parent (85% were mothers) came to the university clinic at each measurement point and the visits generally lasted 4–5 h.

2.3 | Variables

Trained personnel with extensive experience of working with families and children conducted the Preschool Age Psychiatric Assessment.[12] This semi-structured psychiatric interview of parents was used to assess BII phobia in children at 4 and 6 years of age. At subsequent follow-up visits, the Child and Adolescent Psychiatric

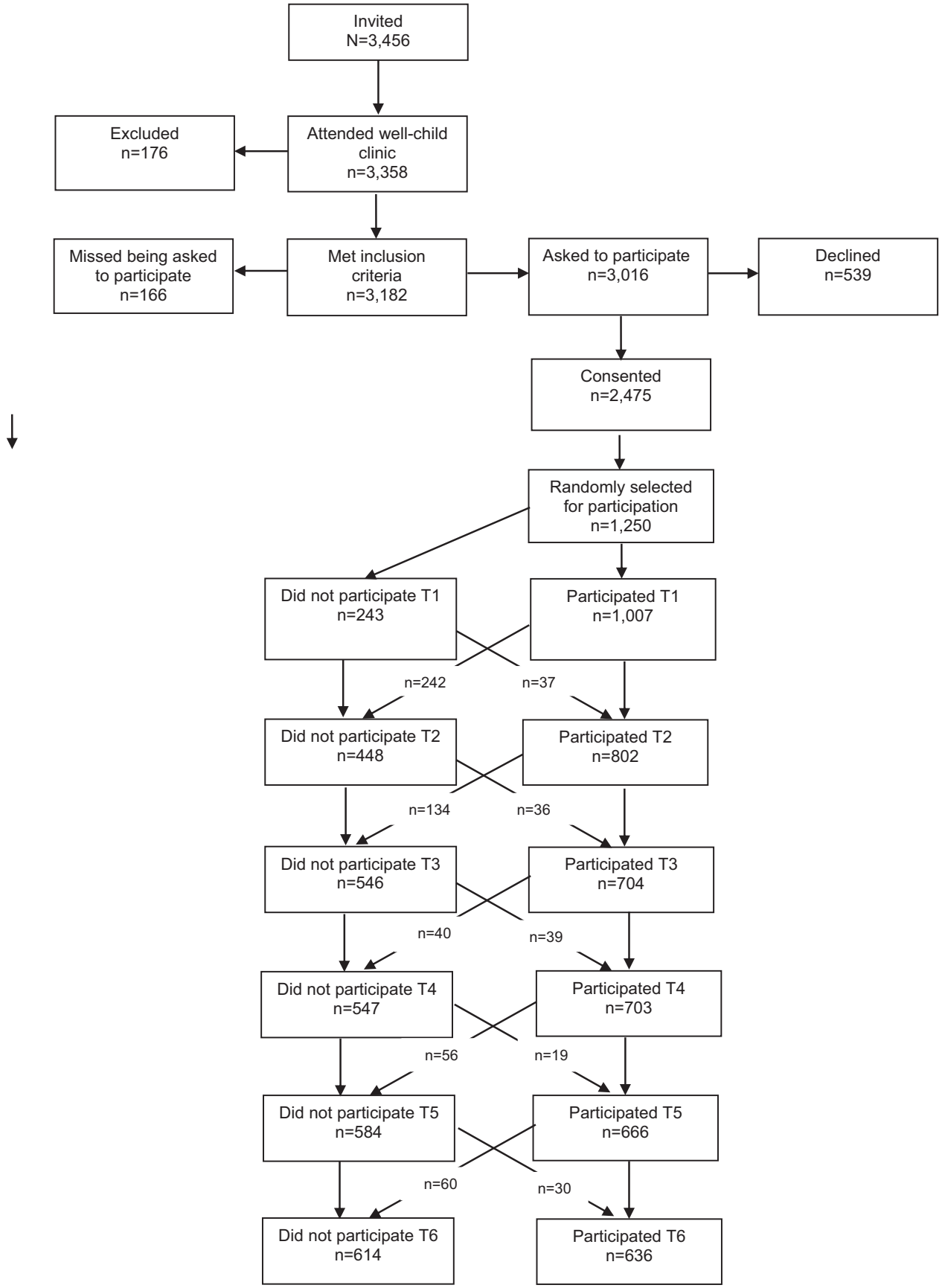


FIGURE 1 Flowchart of recruitment and follow-up. Number of participants at the various assessment points is based on the number of participants invited to participate ($n = 1250$) minus those who did not participate at the respective measurement point (i.e., T1, T2). time point 1 (T_1) = age 4 years, T_2 = age six, T_3 = age eight, T_4 = age 10, T_5 = age 12 and T_6 = age 14.

Assessment[13] was administered to parents and children separately. The Preschool Age Psychiatric Assessment and Child and Adolescent Psychiatric Assessment comprise structured protocols with required and optional follow-up questions. These are used to identify symptoms. which are defined according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition.[4]

Fear of blood and injections was defined as subjective anxious reactions to the sight of blood and to receiving or seeing injections. It also included anticipating the sight of blood or receiving or seeing injections. Fear of injury was defined as subjective anxious reactions that were specific to the possibility of being hurt. To receive a diagnosis of BII phobia, the BII fear needed to intrude into at least one activity and be uncontrollable at least some of the time, in line with the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition. BII phobia subtypes, blood and injection phobias and injury phobias were assessed separately. A BII phobia was considered to be present if it was reported by either the parent or child. Blinded, trained and well-experienced coders assessed the Preschool Age Psychiatric Assessment and Child and Adolescent Psychiatric Assessment interviews. We used different coders for the parent and child interviews. They recorded videotapes of 89 Preschool Age Psychiatric Assessments ($\kappa = 0.78$) and 187 audio tapes of the Child and Adolescent Psychiatric Assessment interviews ($\kappa = 0.79$).

2.4 | Statistical analyses

Latent growth curves were used to investigate overall changes in the prevalence of BII phobia during the study period, by identifying linear and quadratic growth. Because BII is categorical, no absolute goodness of fit indices are available. We compared nested models based on the difference in Akaike's information criterion (AIC), the sample size-adjusted Bayesian information criterion (SABIC) and the Satorra-Bentler scaled chi-square difference test[14] using the log-likelihood. A growth mixture modelling approach[15] was used to evaluate whether heterogeneity in the growth parameters, namely the intercept, linear and quadratic growth, were clustered. To determine the appropriate number of unobserved trajectory groups, we used the Vuong–Lo–Mendell–Rubin likelihood ratio test.[16] This compared the fit of *k* versus *k*–1 classes, in addition to class size and clinical interpretability. Logistic regression analyses examined stability from one measurement point to the next. We also wanted to test whether a diagnosis of BII phobia predicted BII phobia 2 years later when all the unmeasured time-invariant confounding effects were adjusted for. To do this, we drew on random intercept cross-lagged panel modelling,[17] but only examined autoregressions. In this model, the between-person part was represented by a latent factor loading on BII at all time points, with the factor loading set to one. A latent indicator was defined at each time point, loading on the observed BII. The factor loading was set to one and the variance in the observed variable was set to zero, thereby transferring the variance to its latent counterpart. Moreover, as suggested by Asparouhov and Muthén,[18] we accommodated the use of categorical variables in these random intercept models, by setting the variances and residual variances in the within-person part to one. These latent variables captured the child's deviation from their overall level of BII at the moment in question, namely the within-person part. These deviations were regressed on the deviation 2 years before.

All statistical analyses were performed in Mplus, version 8.5 (MPlus Group)[19] using a maximum likelihood with robust standard errors (MLR) estimator. This yielded robust standard errors, except for the random intercept models, where a weighted least square mean and variance adjusted estimator was applied. Missing data were treated according to a full information maximum likelihood procedure. Because we oversampled children with high SDQ scores, the data were weighted back to the original cohort proportions. This was done using a factor corresponding to the number of children in the population stratum, divided by the number of participating children in the stratum. Standard errors were computed using a sandwich estimator. Age and sex differences were examined by comparing a model where the parameters were equal between sexes and ages with a model where they could differ, using a Wald test.

3 | RESULTS

3.1 | Prevalence

As Table 1 indicates, the prevalence of BII phobias increased from about 3% at 4 years of age to a peak of about 8% at 10 years of age, before levelling off. A linear growth analysis covering 4–14 years of age revealed a yearly increase of 0.45% (95% CI 0.23–0.68, $p < 0.001$). The model fit was chi-square (59) = 204.68, $p < 0.001$, AIC = 1703.55, SABIC = 1710.64. Adding a quadratic component to this growth improved the model fit to chi-square (57) = 144.84, $p < 0.001$, AIC = 1691.21, SABIC = 1701.83, Δchi-square (2) = 14.98, $p < 0.001$, ΔAIC = 12.34, ΔSABIC = 8.81. However, a piecewise growth model with one linear growth from 4 to 10 years and another from 10 to 14 years fitted the data even better than a quadratic model. Chi-square (57) = 140.32, $p < 0.001$, AIC = 1688.55, SABIC = 1699.18, ΔAIC = 2.66, ΔSABIC = 2.65 supported the two-part change in prevalence depicted in Table 1. BII phobias increased linearly by 0.57% per year from 4 to 10 years of age (95% CI 0.17–0.98, $p = 0.006$), but not from 10 to 14 years, where there was a yearly reduction of −0.16%, (95% CI −0.36–0.65, $p = 0.53$).

3.2 | Trajectories

When we examined the heterogeneity in linear and quadratic growth with growth mixture modelling. This revealed that three classes proved a better fit to the data than two classes, according to the Vuong–Lo–Mendell–Rubin likelihood ratio test (Δ −2LL, 7.60, parameter difference, 4, $p = 0.005$). Four classes were not superior to three classes, according to the same test (Δ −2LL, 22.83, parameter difference, 4, $p = 0.68$). The three-class solution (Figure 2) identified

TABLE 1 Prevalence of blood–injection–injury phobia at ages 4 to 14 years.

	Blood–injection–injury phobia (%, 95% CI)				
Age (years)	All	Boys	Girls	Wald test	*p* Value[a]
4[b]	2.90 (1.79–3.83)	3.19 (1.54–4.85)	2.60 (1.13–4.08)	0.27	0.60
6	4.14 (2.73–5.56)	3.69 (1.78–5.60)	4.59 (2.51–6.68)	0.40	0.53
8	4.47 (2.87–6.06)	3.67 (1.67–5.67)	4.79 (2.40–7.11)	0.51	0.48
10	8.51 (6.29–10.72)	7.18 (4.24–10.11)	9.32 (6.12–12.51)	0.94	0.33
12	6.09 (4.21–7.97)	5.90 (3.22–8.59)	6.28 (3.65–8.91)	0.04	0.84
14	7.35 (5.13–9.56)	5.58 (2.83–8.33)	8.91 (5.54–12.28)	2.25	0.13
At least one occurrence of BII phobia					
4–14	19.53 (15.78–23.28)	15.74 (10.84–20.64)	22.78 (17.26–28.29)	3.49	0.061

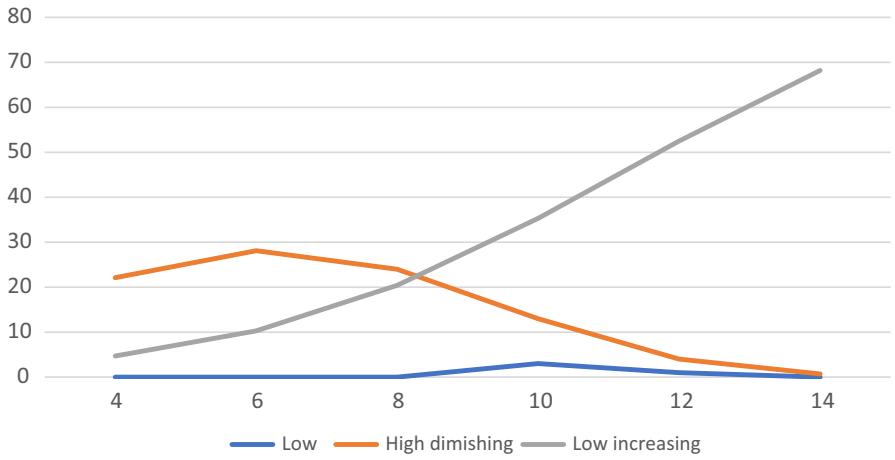
Note: Estimates are based on all available information from all time points and population weights have been applied.

Abbreviation: CI, confidence interval.

[a]Logistic regression analysis.

[b]Numbers are unweighted numbers of boys and girls at each time point.

FIGURE 2 Prevalence of blood–injection–injury (BII) phobia in three classes of children.



a no BII phobia group that contained 78.8% of the children. There was also a moderately sized high to decreasing BII phobia group (10.9%) with an initial high risk of BII phobia that diminished over time. Lastly, there was a low and increasing BII phobia group (10.4%), whose trajectory began with no risk of BII phobia at the ages of 4 years but reached a very high risk at 12–14 years of age.

In all, 19.5% of the cohort were diagnosed with BII phobia at least once, with no sex differences (Table 1): 10.6% once, 4.6% twice, 3.0% at 3 time points, 0.8% at four and 0.2% at five. No child was diagnosed with BII phobia at all 6 time points. The contribution of injury phobias to BII phobia varied between 16.0% at 8 years of age down to 2.2% at 12 years of age.

3.3 | Stability of diagnosis

A diagnosis of BII phobia at 1 time point increased the risk of being diagnosed again after 2 years, with ORs from 4 to 12 years of age (Table 2). However, the OR increased sharply from 12 to 14 years of age and was higher than the change from 10 to 12 years of age (Wald = 60.85, df = 1, $p < 0.001$). Having a BII phobia at 4 years of age did not increase the risk of a diagnosis at 12–14 years of age (OR 1.22, 95% CI 0.36–4.15, $p = 0.77$), but a diagnosis at 8–10 years of age did (OR 9.83, 95% CI 4.63–20.86, $p = 0.019$). A diagnosis at 4 or 6 years of age predicted a diagnosis at 8 or 10 years of age (OR 5.75, 95% CI: 2.71–12.21, $p = 0.031$). A random intercept model revealed that all two-year stabilities were significant: at 4 to 6 years of age (B 0.51, $p = 0.02$), 6 to 8 years (B 0.48, $p = 0.02$), eight to 10 years (B 0.59, $p < 0.001$), 10 to 12 years (B 0.17, $p < 0.001$) and 12–14 years (B 0.98, $p < 0.001$).

4 | DISCUSSION

The natural course of BII phobias in childhood has been largely unknown, but it has been noted that they develop at an early age and are particularly chronic and debilitating.[5,8,9,20] This causes considerable suffering in paediatric patients.[5] That is what prompted us to examine the prevalence, stability and course of BII phobia from preschool to adolescence, namely 4–14 years of age, in a representative

TABLE 2 Two-year stability and change in stability of blood–injection–injury phobia. Logistic regression.

Age (years)	2-year Stability, OR (95% CI)	Change in stability		
		Wald test	*p*-Value	Comparisons (Age intervals, years)
4–6	11.72 (4.21–32.69)			
6–8	7.82 (3.00–20.39)	0.34	0.56	4–6 and 6–8
8–10	8.24 (3.52–19.28)	1.18	0.28	6–8 and 8–10
10–12	8.52 (4.08–17.80)	0.78	0.30	8–10 and 10–12
12–14	34.19 (14.82–78.90)	10.19	0.001	10–12 and 12–14

Note: Estimates are based on all available information from all time points and population weights have been applied.

Abbreviations: CI, confidence interval; OR, odds ratio.

community sample. Almost a fifth of the children met the criteria for BII phobia at least once, increasing from about 3% at age 4 years of age to 8% at 10 years of age, at which point the prevalence stabilised. The course of BII phobia followed three distinct trajectories. One group faced a high risk of BII at 4 years of age, but this declined at 8 years of age and during adolescence. An equally sized second group showed the opposite pattern, with initial low, but increasing, risks. The third, and largest, group exhibited no BII phobia. The presence of BII phobia at all ages predicted that it would still be present 2 years later, but there was a substantial increase in stability at 12–14 years of age. Having a BII phobia at 4–6 years of age did not increase the risk of a BII phobia at 12–14 years of age. When the effect of unmeasured time-invariant confounding effects was adjusted for, having a BII phobia implied an increased BII phobia risk 2 years later throughout childhood and adolescence.

Estimates of the lifetime prevalence of BII from retrospective surveys conducted in adulthood have varied between 0.8%[5] and 9.1%,[6] but we report a considerably higher 19.5% prevalence over a 10-year period. This may be due to several factors. The information was collected from both children and parents, rather than just self-reports from children. In addition, clinical interviews were used, as opposed to checklists. The prospective design limited recall bias to 2 years, as opposed to adults in mid-life or older recalling childhood fears. The fact that older adults who have taken part in other studies have reported considerably lower lifetime rates than younger adults supports the notion that recall issues may lead to underreporting.[7,21] This means that the present approach may have produced higher and more valid estimates.

Our finding that BII phobias increased from 4 to 10 years of age before stabilising contrasts with findings from cross-sectional studies of BII[19,22,23] and needle phobias.[24,25] These reports chronicled the opposite developmental pattern, where the prevalence of BII phobia was highest among the youngest subjects and decreased with increasing age. Several factors may have contributed declining rates throughout childhood. These include adults finding it difficult to date the onset of childhood BII phobias and the use of clinical samples, which may have a different course to the general population.

Further research is needed on why the BII phobias in our study rose at 8 years of age, but we offer some possible explanations. During this period, children encounter an increasing number of potential conditioning events that can trigger BII phobias, like vaccinations, venepuncture and local anaesthetic injections before restorative dental treatment. Cognitive maturation at 8 years of age enables children to better conceptualise negative consequences, which may increase fear and worries.[26]

Parents typically grant their children greater autonomy at 8 years of age. Some children may use this autonomy to avoid unpleasant situations, such as medical procedures, which may negatively reinforce BII phobias. Thus, preventive efforts and effective treatment for BII phobias at 8 years of age, and during adolescence, could be especially valuable. Many effective approaches are available. Techniques to prevent BII phobias include self-help tools, pain management and distraction methods, such as handheld videogames and virtual reality technology. One recommended method for treating phobias is cognitive behavioural therapy.[27]

Our results do not fully support the common beliefs presented by previous studies that BII phobias are highly stable and have a particularly early onset.[20,28] We observed moderately high stabilities and incident cases that also appeared at 8 years of age and adolescence. We found that around 65% of the one-fifth who received a diagnosis over the 10-year observation period, received the diagnosis only once and 14% only twice. This further supports the notion that a paediatric BII phobia is only moderately stable. However, the cross-sectional nature of previous studies did not differentiate between prevalence at the population level and individual trajectories. Moreover, rates and onsets may have been subject to systematic recall bias. Studies that rely on autobiographic memory consistently chronicle the present state of a person and this can colour their recall of past events.[29] Putting these general trends aside, our results suggest that the course and stability of BII phobias at 4–6 years of age may differ from those in adolescence. That is why the following text addresses these developmental periods separately.

Contrary to the position at 4–6 years of age, the stability of BII phobia increased at 12–14 years of age. Another group of children with no or little propensity toward BII phobias at 4–5 years of age followed a trajectory with steeply increasing risk throughout 8–9 years of age and adolescence. It is possible that these adolescents may, when they reach adulthood, report that their BII phobia began at an early age, due to autobiographic memory biases or other reasons. BII phobia in late middle childhood and adolescence strongly predicted

persisting BII phobias, adjusted for all unobserved time-invariant confounding effects. This finding was consistent with the view that avoidance is operative and contributes to a more chronic course. Treatments involving exposure may be promising, as several clinical trials have suggested.[4,20,30,31] However, preventive measures that identify the early predictors of belonging to this low and increasing BII phobia group will be important.

The present study had many strengths, including a birth cohort sample with repeated follow-up visits, the use of clinical interviews by trained personnel and a strong statistical approach to estimate stability. However, there were also some limitations. Despite the large sample size, the low prevalence of BII phobia at younger ages resulted in wide confidence intervals. This meant that the prevalence and stability estimates at younger ages were less precise than at older ages. The diagnostic interviews were completed every second year, so BII phobia that emerged and vanished between the assessment points could not be recorded. This could have resulted in possible deflated lifetime prevalences and inflated stability estimates. The prevalence of childhood psychiatric disorders, and the expected exposure to invasive medical procedures. may vary between countries. As a result, readers should be cautious about making generalisations to other countries and cultures. Although the results were representative for Trondheim city, the participants were mainly white. Therefore, caution should be exercised regarding generalisations to other ethnic groups.

5 | CONCLUSION

A fifth of children aged 4–14 years of age were diagnosed with a BII phobia. The prevalence was low at 4 years of age, increased toward 8 years of age and stabilised at a 6%–8% level by 12–14 years of age. In addition to this general population trend, the individual trajectories followed three distinct paths. Most children (81%) never experienced BII phobia. Another 11% had a moderately high propensity toward BII at 4 years of age, which vanished at 8 years of age onwards. The other 10%, seldom or never experienced a BII phobia at 4 years of age but developed a very high risk in late middle childhood and at 12–14 years of age. The two-year stability of BII phobias was moderate but increased toward 12–14 years of age. However, there was no continuity of BII phobias from 4 to 14 years of age. In most cases, early emerging BII phobia will not require intervention as it typically recedes with time. Efforts to treat BII phobias from 8 years might be warranted.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ORCID

Lars Wichstrøm https://orcid.org/0000-0003-3199-4637
Göran Dahllöf https://orcid.org/0000-0001-8536-5292

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