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METHOD ARTICLE

Conducting longitudinal cohort research in secondary schools: Insights from the Born in Bradford Age of Wonder study

[version 1; peer review: 1 approved with reservations]

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Abstract

Background

Adolescence is a critical period of development which paves the way for longer term health trajectories and lifestyles. Understanding the variety of factors which influence adolescent health is crucial to developing interventions and services which have the potential to influence health across the life-course. Collecting representative, longitudinal data with adolescents at scale is difficult. Secondary school settings offer an excellent opportunity to collect such data with adolescents, however, there are inherent challenges in working with these settings. The Born in Bradford Age of Wonder (AoW) study aims

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to capture the health and wellbeing trajectories of up to 30,000 adolescents living in the diverse and multi-ethnic city of Bradford, UK.

Methods

This paper presents key challenges and associated lessons from the first three years of implementing the AoW programme across Bradford secondary schools. Challenges and lessons are described across seven thematic areas, with illustrative examples of how these learnings subsequently fed back into the programme design. These reflections later inform key recommendations to help guide future researchers.

Results

Notable challenges in implementing the research programme included collecting data for opt-in measures, providing tailored approaches for individual schools with differing facilities and needs, fitting data collection within school timings, and returning tangible value to schools and students in a responsive way. Key lessons included engaging schools as partners, enacting rigorous ethical processes and balancing flexibility with programme fidelity. Co-production and regular stakeholder engagement (including parents, teachers, students) ensured alignment between the programme delivery and local needs and priorities. Our recommendations describe successful implementation as a three-phased iterative process of preparation, implementation, and sustained engagement.

Conclusions

Conducting longitudinal health research in secondary schools is a highly dynamic and complex process. By embracing co-production, operational flexibility, and cohesive working practices, AoW offers a model for conducting large-scale research in UK secondary schools.

Plain Language Summary

The Born in Bradford research programme has been following the health and wellbeing of over 13,000 Bradford children since birth. These children are now teenagers, an extremely important time in shaping our long-term health and wellbeing. Secondary schools are potentially a great place to carry out research with teenagers but very little is known about how best to do this. Since 2022, Born In Bradford Age of Wonder has been following teenagers' health and wellbeing by collecting data from students in schools across Bradford. Data has been collected using questionnaires, physical health measurements, and computer-based assessments of memory, movement and language. This paper describes the key challenges we've faced in doing this research, the lessons we've learnt, and our recommendations for how to conduct health research in secondary

schools. Key challenges included building and maintaining relationships with schools, managing data collection in different school settings, and showing schools and students the value of being involved. Lessons included working flexibly, treating schools and students as partners, and sharing research results with the people who provide the data, amongst others. We hope that future researchers working with schools will use the lessons we've learnt to improve their research projects.

Keywords
Born in Bradford, Adolescent, mental health, wellbeing, ethnicity, obesity, cognitive development, cohort, schools

This article is included in the Born in Bradford gateway.

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Background

Adolescence is a critical period in human development, characterised by rapid physical, cognitive, and social changes that shape health behaviors and trajectories across the life course[1]. During this time, adolescents develop health patterns, such as dietary habits, physical activity, and coping strategies that can have long-term consequences for their mental and physical well-being[2–4]. These patterns are influenced by an interplay of factors, including changes in body composition[5], neurocognitive development[6], and social environments[7]. Recognising this, researchers have highlighted adolescence as a unique opportunity to intervene and positively influence health outcomes on a population level[8]. Longitudinal studies, which allow researchers to map health trajectories, identify critical risk and protective factors, and assess the long-term impact of interventions are needed to understand how best to leverage this critical period for life-long health. This need is particularly pronounced in multi-ethnic and socio-economically diverse communities, where cultural and systemic factors may impede participation and influence outcomes[9,10].

Schools offer a natural setting for conducting research on adolescent health. In England, education is compulsory until 16 years old (young people must stay in education or undertake training via internship, apprenticeship or pursuit of an equivalent regulated qualification until 18 years old)[11] and is primarily delivered in secondary schools and colleges. Schools bring together students from various socio-economic, cultural, and ethnic backgrounds, and with over three million adolescents attending secondary schools in England alone[12], for up to 190 days annually[13], these settings have the potential to offer rich data collection over time. Furthermore, schools have regular communication with parents and often have existing administrative systems that facilitate longitudinal tracking of students across academic years. Despite these advantages, conducting research in schools presents unique challenges. Researchers must navigate complex ethical considerations, including securing the trust and consent of students, parents, and school leadership[14]. Logistical hurdles such as varying school resources, high staff turnover, and competing demands on school schedules can further complicate data collection. Longitudinal studies face additional obstacles, including participant attrition during key transition periods (e.g. students leaving school at post-16 age) and the need to maintain engagement with schools and students over extended periods[15–17].

Born in Bradford (BiB) is a longitudinal birth cohort based in Bradford, a large northern UK city. BiB initially recruited 12,453 women with 13776 pregnancies between 2007 and 2011 and has been following the lives of these families over subsequent years, collecting data through questionnaires, physical measurements and routine data linkage[18]. When the cohort was of primary school age, a sweep of the entire cohort was planned to collect data through surveys, cognitive assesements and physical and biological health measures[19]. Utilising primary school settings for the programme proved very successful. Between 2016–2019 BiB worked with 89 primary schools in the city to collect detailed information on 9,805 BiB children, and 10,201 of their peers. The cohort are now in adolescence, and the new phase of the cohort, BiB Age of Wonder (AoW) is currently aiming to recruit up to 30,000 adolescents, again utilising school-based settings for quantitative data collection, but for the first time working in secondary education settings.

There are recent successes in utilising secondary school settings to collect research data. The #BeeWell [https://beewellprogramme.org/research/survey/][20] and OxWell [https://oxwell.org/][21] studies have both implemented an online questionnaire approach. Since 2021, the #BeeWell study has worked with schools across the Greater Manchester Combined Authority to collect questionnaire data using online surveys from 37,000 young people in the longitudinal arm of the study. Key insights included the importance of feeding back data to schools, and #BeeWell created a valued data dashboard for schools looking for insights on their populations. However, AoW data collection includes not only questionnaires, but additional face-to-face measurements (e.g. biological samples, motor and cognitive tests), which can pose a greater logistical challenge for the schools and exacerbate existing challenges around communication and capacity.

This paper aims to share insights from the first three years of implementing the quantitative arm of AoW, focusing on the challenges and opportunities of conducting longitudinal research in secondary schools across a range of measures. By reflecting on our experiences, we aim to provide practical recommendations for researchers conducting similar research studies in school settings.

Methods

Study context

The AoW programme[22,23] is situated in Bradford, a city in northern England known for its cultural and ethnic diversity. Bradford is home to a population with significant health and socioeconomic disparities[24,25], making it an important context for studying adolescent health trajectories. Education settings for adolescents across the district include 35 mainstream secondary schools, 5 special schools, 2 alternative provision schools, and 6 independent schools[12]. The city's secondary school population is characterised by a high proportion of students from South Asian backgrounds, as well as a substantial number eligible for free school meals[24], highlighting the need for equitable and inclusive research practices. When AoW was launched, students were transitioning into adolescence in the wake of the covid-19 pandemic. This period saw young people experience disrupted education, social isolation and increased mental health challenges[26], while the education system struggled with widespread real-term funding cuts[27,28], teacher absences[29] and other challenges.

Study design

AoW aims to follow up to 30,000 young people, including the original BiB cohort and their peers, through secondary school and into adulthood over a seven year period. AoW recruitment

primarily focuses on mainstream schools, as these schools contain large amounts of existing BiB participants. However, AoW also works with alternative settings and independent schools, to further efforts to minimise sampling biases and collect representative data. Piloting took place in early 2022, with full-scale recruitment and data collection occurring from September 2022 onwards. The programme collects quantitative data using the following methods:

1. **Questionnaires:** Years 8, 9 and 10 students (age 12–15 years old) respond to questions covering a range of topics, including mental health, well-being, socioeconomic status, and physical health. Questionnaires can be completed online on school computers, or offline on tablets brought in by the research team, at the school's request.

2. **Health Measurements:** Year 9 students only (age 13–14 years old). Anthropometric measures (height, weight, and body composition); blood pressure; and skinfold thickness are collected. These are collected by the research team in private pop-up booths in the school.

3. **Cognitive Assessments:** Year 9 students only (age 13–14 years old). Tasks measuring cognitive and motor skills are completed on tablets brought in by the research team, in a classroom setting, to capture developmental trajectories.

4. **Biosamples:** Year 9 students only (age 13–14 years old). Venous blood samples are taken for laboratory profiling and biobank storage. These are collected by the research team in private pop-up booths in the school.

Methods 1–3 utilise an opt-out consent model, and method 4 utilises an opt-in consent model with parents. Schools are asked to provide written consent and sign a data sharing agreement in order to take part. A senior member of school staff is asked to host a booking meeting (online or in-person) in order to arrange introduction assemblies for participating year groups (a general launch assembly, and a separate assembly to cover the blood sample and opt-in consent process as part of Year 9 data collection), distributing information sheets and consent forms to parents, collating class lists, and data collection sessions. The full protocol for the quantitative methods as delivered in secondary schools has been published and more details on these methods are provided there[22].

Key challenges and lessons learnt

The AoW programme generated a wealth of insights over its first three years, encompassing logistical, ethical, and relational aspects of conducting longitudinal research in secondary schools. These insights supported iterative development and growth of the programme, and AoW successfully progressed from collecting data in four schools for piloting, to 15 schools in year one of full-scale data collection, to 26 schools in year two. This enabled AoW to collect comprehensive health and wellbeing data with a large multi-ethnic and socio-economically diverse sample of young people (see Table 1 and Table 2).

The remainder of this section summarises key challenges encountered through the first three years of AoW, and describes corresponding lessons learnt. Challenges and lessons are structured around seven thematic areas identified during implementation.

1. Co-production and stakeholder engagement

Co-production and stakeholder engagement was central to achieving the aims and ambitions of AoW. Notable challenges relating to this theme included: (1) encouraging reluctant young people to participate in the research and overcoming a potential lack of interest, enthusiasm or trust (2) connecting effectively with broader stakeholders and policymakers. Addressing these challenges was imperative to the relevance, long-term sustainability and impact of AoW.

Key lessons include:

- **Alignment with Public Needs and Priorities:** A central pillar of AoW was its co-production approach, which emphasised collaboration with schools, students, and families throughout the research process, including shaping study documentation, co-designing questionnaires, and disseminating AoW findings. AoW's co-production approach was based on the core values (equality, agency, reciprocity) and principles of the ActEarly co-production strategy[30] which was co-developed by BiB researchers. Co-production enabled the alignment of study priorities with those of the schools and students. For example, young people's input led to significant changes to the questionnaires, including the removal of certain subjective social status measures[31], and the inclusion of measures addressing social media use and academic stress. This boosted the relevance of our measures, enhancing engagement and garnering response rates in year two of 72.1% and 67.8% for modules 1 and 2 respectively; both figures are much higher than average response rates for online surveys (44.1%)[32].

- **Positive Impacts for Peer Researchers:** Adolescents involved in our co-production work as peer researchers reported increased confidence, improved communication skills, and a greater understanding of research processes[33]. These learnings underscore the value of embedding co-production values and principles into longitudinal research, both for project delivery and for those involved in co-production.

- **Collaboration with Local Authority and key stakeholders:** Positive networks enabled collaboration between AoW and the local authority (City of Bradford Metropolitan District Council), which was conducting a similar school-based survey before AoW launched. Rather than run in parallel and overburden schools, AoW and the local authority agreed to include key public health outcomes around drinking, drugs and gambling in the AoW questionnaire. AoW data collection presented an opportunity to provide rich detail around key public health priority areas for the local authority, helping to shape local policy-making.

2. Tailored school recruitment/engagement

Recruiting schools required tailored and persistent engagement strategies. Challenges in recruiting schools included: (1) schools

Table 1. Breakdown of AoW Questionnaire Participants for Pilot, Year 1 and Year 2 of data collection.

	Bradford Census population[12] n (%)	Participants* (Pilot) n (%)	Participants* (Year 1 - 2022–23) n (%)	Participants* (Year 2 - 2023–24)** n (%)
Schools (data collected)		6	15	26
Year Group				
8	7366 (33.4)	542 (48.3)	1570 (31.7)	3386 (35.6)
9	7389 (33.5)	248 (22.1)	1770 (35.7)	3370 (35.5)
10	7276 (33.0)	332 (29.6)	1613 (32.6)	2747 (28.9)
Sex				
Female	10940 (49.7)	523 (46.6)	2645 (53.4)	4957 (52.2)
Male	11090 (50.3)	548 (48.8)	2307 (46.6)	4546 (47.8)
Missing	1(0.0)	51 (4.6)	1 (0.0)	0 (0)
Ethnicity				
Asian or Asian British	9603 (43.6)	683 (60.9)	3038 (61.3)	4592 (48.3)
Black or Black British	654 (3.0)	25 (2.2)	129 (2.6)	344 (3.6)
Mixed or Multiple ethnic groups	1311 (6.0)	64 (5.7)	199 (4.0)	499 (5.3)
Other ethnic groups	404 (1.8)	36 (3.2)	88 (1.8)	171 (1.8)
White	9630 (43.7)	298 (26.6)	954 (19.3)	3712 (39.1)
None recorded	390 (1.8)	16 (1.4)	545 (11.0)	185 (1.9)
Missing	39 (0.2)	0 (0)	0 (0)	0 (0)
FSM				
No	15106 (68.6)	N/A	3440 (69.5)	6743 (71.0)
Yes	6925 (31.4)	N/A	1420 (28.7)	2760 (29.0)
Missing	0 (0)	N/A	93 (1.9)	0 (0)
SEN				
No	18146 (82.4)	N/A	3429 (69.2)	7706 (81.1)
Yes	3885 (17.6)	N/A	670 (13.3)	1362 (14.3)
Missing	0(0)	N/A	854 (17.2)	435 (4.6)
Total	22031 (100)	1122 (100)	4953 (100)	9503 (100)

* figures correspond to the number of participants who completed at least one of the questionnaire modules as part of AoW. For the pilot and year 1, this constitutes taking part in any of module 1–4; for Year 2, participation constitutes taking part in module 1 or 2. Demographic information taken from school-compiled class lists.

** figures for 2023/2024 are preliminary and may change slightly once all data processing and data checks have been finalised.

NA = not assessed.

Table 2. Breakdown of AoW Health Measures and Motor and Cognitive Assessments for Pilot, Year 1 and Year 2 of data collection.

	Participants (Pilot) n	Participants (Year 1 - 2022–23) n	Participants (Year 2 - 2023–24)* n
Motor & Cognitive Assessments (Opt-out)	N/A	862	2288
Health Measures (Opt-out)			
Bioimpedance	196	1418	2140
Blood Pressure	58	1689	3069
Skin fold	32	1467	2813
Height/Weight	219	1731	3174
Health Measures (Opt-in)			
Blood Samples	38	282	411

* figures for 2023/2024 are preliminary and may change slightly once all data processing and data checks have been finalised.

lacking awareness of or trust in BiB and the AoW programme, (2) a singular and fixed approach to recruitment holding inadequate effect or relevance for different schools with different needs and priorities, (3) incongruity between research activities and school timelines.

Key lessons include:

- **Relationship Building:** Establishing trust with school leadership teams (SLTs) was critical. This involved leveraging local and trusted networks, such as multi-academy trusts, and maintaining consistent points of contact with schools.
- **Context-Specific Approaches:** Recognising the school context and adapting our approach accordingly greatly bolstered our efforts. For example, £500 was originally offered to schools as remuneration for their participation each year; this was doubled to £1000 in light of both the financial strain many schools were operating under, and the substantial administrative burden AoW entailed. The AoW offer was aligned to the Ofsted inspection criteria; Ofsted is the Office for Standards in Education, Children's Services and Skills, and provides inspection services for UK school and college settings.
- **Detailed Documentation:** Detailed records of each school's demographics, priorities, and constraints informed personalised communication strategies. Gathering and documenting soft intelligence such as school contacts' preferred times and methods of communication, key school staff turnover helped tailor our approach and maintain positive relationships with schools.
- **Aligning with School Calendars:** Consultation with school contacts and soft intelligence gathering helped us learn the importance of aligning the programme delivery with school and staff calendars. Temporal considerations included learning on which days school contacts were typically available, minimising communications during busy school periods (e.g. September, exam periods, Ofsted inspections) and booking data collection activities months in advance to fit around term times and crucial school activities (trips, performances, themed weeks), as was normal practice in several schools. These lessons enabled us to maintain positive relationships with schools and over time helped situate AoW as an embedded part of the school calendar.
- **School Champions:** Engaging influential individuals, such as headteachers and local authority officials, facilitated access to schools and strengthened partnerships.

3. Piloting and testing

Given the scope and ambition of AoW, crucial technical and logistical challenges included designing processes and systems that (1) were viable and feasible within a school setting, (2) enabled consistent programme delivery across multiple school contexts. A related temporal challenge involved having adequate processes in place in time for AoW data collection to align with the entry of the original BiB cohort into year 8. Piloting and ongoing testing facilitated the design and refining of these systems and processes.

Key lessons include:

- **Optimising Questionnaire Length:** During the first year of data collection, it became apparent that students struggled to complete the questionnaires in the time allowed (as questionnaires were administered during lesson time). Co-production with young people favoured shorter (circa 10 minutes) questionnaires more often, but the administrative burden this would place on schools was found to be unfeasible. In the first year we administered the survey in four modules, however many schools struggled to finish all four modules (modules 1 and 2 were completed in 15 schools compared to

8 schools for modules 3 and 4). There were wide variations in sample sizes and response rates (RR) across module 1 (N = 4353, RR = 50.4%) module 2 (N = 3932, RR = 45.5%), module 3 (N = 2026, RR = 23.5%) and module 4 (N = 1868, RR = 21.6%). For year two of data collection we implemented a survey instrument consisting of two modules that could be completed within a single 50-minute school session. This meant our questionnaires had to be cut by 50% from initial plans. However, this was much more amenable to schools and year two saw a substantial increase in the number of schools completing questionnaires (25 schools completed modules 1 and 2); response rates for year two were consistently higher, with schools reliably producing response rates of 67% and over. We also removed some of the motor and cognitive tasks so the overall assessment could be easily completed in 30 minutes.

- **Pre-testing IT Systems:** During the pilot phase, we identified compatibility issues between school IT systems and the online survey platform, for example, where domains or external links were blocked by firewalls. Pre-testing school online systems with dummy questionnaire links sent to accounts with "student-like" credentials enabled us to address these issues in advance and reduce disruptions during data collection.

- **Flexible questionnaire delivery platforms:** Piloting highlighted the need for portable tablets for offline data collection in schools with limited IT resources; whilst this incurred a substantial financial cost to the research budget, this was necessary to enable all schools to participate. This change to our offer was welcomed by schools, with offline data collection accounting for over 60% of survey responses in year two. We also found a broader range of missing responses for online (~2.5 – 25%) than offline delivery (~2.5 – 8.5%). We speculate this is mainly due to a more consistent presence of a research team member for offline delivery compared to online, whereby teachers were asked to help facilitate session delivery.

Piloting ensured that the study design was both efficient and feasible across different school settings, enabling schools to take part and helping to mimimise sampling biases. Meanwhile, the iterative nature of the study design ensured that lessons learned during the pilot and early implementation phases could be incorporated into subsequent waves of data collection. That said, allocating more time to pilot, at least one full academic year, may have helped alleviate these issues before progressing to full-scale data collection.

4. Ethics and consent

Ethical practice was central to AoW, with specific attention given to obtaining informed consent in a manner that was ethically rigorous, publicly acceptable, and practical within a school setting. Notable challenges included (1) multiple consent models leading to confusion amongst prospective parents/students/schools, (2) participant information sheets and consent forms being unclear, difficult to understand, or overly long, (3) opt-in consent for blood samples resulting in low participation possibly due to breakdowns in communication chains from research team to parents, participant apprehension or concern regarding giving blood samples.

Key lessons include:

- **Iteration and Refinement:** During early implementation we offered diverse models of consent (including one where all measures were opt-in), intending to give schools and parents greater freedom of choice and minimise concerns regarding potentially sensitive measures such as weight or more invasive measures such as blood samples. Blood samples were consistently identified by schools and parents as a measure requiring opt-in consent (and this aligned with our ethical standards); however, no school took up the offer of additional opt-in measures and in practice, students did not express any distress regarding weight measurements. Moreover, some schools expressed confusion when presented with multiple models of consent. This confusion and general acceptance of opt-out consent for most measures informed our decision to simplify to a dual consent model consisting of:

    1. **Opt-Out Consent:** Applied for less intrusive measures such as questionnaires and basic health measurements, following extensive stakeholder consultation. This increased consent rates to over 90%, compared to the ~40% typically seen with opt-in models.

    2. **Opt-In Consent:** Required for the blood sampling, reflecting the study's commitment to respecting participant autonomy. Uptake for blood sampling, reached ~11%, reflecting challenges with more invasive procedures. Enhanced communication strategies, such as Q&A sessions during assemblies, mitigated some concerns with students.

- **Accessibility and Clarity:** Engaging community stakeholders and co-producing study documents helped ensure that they were accessible and prospective participants could make informed decisions regarding their involvement. For instance, participant information sheets were translated into multiple languages, and video formats were created to accommodate varying literacy levels. The team also delivered interactive assemblies for students to address questions and concerns. Separate assemblies were conducted for the opt-out and opt-in measures, while the communication process (i.e. conducting assemblies, disseminating information sheets, sharing information videos, scheduling data collection visits) for each consent process was staggered to reduce confusion for schools, students and parents.

5. Flexibility and adaptability

Flexibility and adaptability was essential for navigating the diverse needs and capacities of participating schools. Challenges necessitating this included: (1) lack of suitable IT facilities to deliver questionnaires in many schools, (2) diverse logistical preferences

across schools in relation to data collection (e.g. condensing questionnaires into shorter times with larger groups of students versus spreading data collection across multiple days with smaller groups). Embracing flexibility and adaptability brought additional challenges such as (1) managing an increased burden on research staff, and (2) mitigating risks posed by increased flexibility to the fidelity and consistency of the programme delivery.

Key lessons include:

- **Tailored Data Collection Models:** We learnt that maximum flexibility and adaptability was central to building relationships with new schools and learning how best to deliver AoW in that particular setting. For example, schools with limited IT resources benefited from the offline data collection model, which involved the use of research team tablets. This approach achieved the highest completion rates, with completion rates exceeding 90% in some schools. We also learnt to readily adapt our delivery models with new schools, e.g. delivering health measures over two shorter days rather than one longer day to minimise school disruption.
- **Process Refinement:** Maximum flexibility was crucial during school engagement and initial data collection. However, a key lesson was the benefit of having a 'flexibility pipeline'. Once trust was established with a school and the research team knew how to deliver the programme in that setting, subsequent years of data collection could move to a more fixed model. This included defining 'non-negotiables' such as operating under a set consent model, requiring class lists to be formatted correctly and sent back to our systems team well in advance of data collection, holding a booking meeting with each school and confirming ahead of time that schools can provide a suitable space for conducting health measures in a private way. Other non-negotiables include staying in one room for each data collection activity (e.g. all health measures take place in one room) and asking schools to provide staff members to ensure behaviour management and safeguarding during data collection. From year two onwards, we also decided to delay any updates or changes to the questionnaires until the summer break. This signified a refinement from previous years, whereby live changes and updates were made to the questionnaires.

6. Operational efficiencies

Efficient operational systems were critical for managing the scale and complexity of AoW. As the programme grew and more schools were recruited, the operational challenges grew in significance, and key challenges included: (1) having enough research staff members to carry out data collection across multiple schools, (2) staying within timelines for data collection, (3) ensuring data quality controls were upheld, and (4) integrating new studies into operational systems with minimal disruption or confusion.

Key lessons include:

- **Cross-Training:** Originally, we had two core data collection groups: one for health measures and one for questionnaires, cognitive assessments, and assembly presentations. However, we learnt that cross-training staff to handle multiple data collection tasks reduced logistical bottlenecks and greatly enhanced efficiency.
- **Booking Meetings:** Researchers and senior school staff jointly scheduled all research activities to ensure alignment with school calendars and research timings. These meetings provided an opportunity to book school facilities (e.g. private space for health measures and classrooms/auditoriums for questionnaires) and research equipment in a timely manner and solve any potential issues ahead of time (e.g. identifying a suitable room for health measures). Introducing these meetings helped to maintain or improve response rates as the programme expanded, e.g. completion rates for opt-out health measurements (defined as giving at least one measure) rose from 66.7% for 15 consented schools in year one to 68.4% for 26 consented schools in year two. We also learnt that once a relationship was established, many schools were happy to schedule data collection for the proceeding academic year at the end of the preceding year (i.e. booking 2023/2024 data collection at the end of 2022/2023) as it enabled more time to factor AoW into their school calendar and curriculum planning.
- **Centralised Booking and Data Systems:** A centralised system for scheduling research activities streamlined logistics (e.g. anticipating busy data collection periods and training up additional team members to support collection) and created a historical record for troubleshooting and reporting.
- **Real-Time Data Checks:** Regular checks during data collection identified issues such as missing responses due to technical glitches, school absences, or unexpected interruptions to data collection activities (e.g. school closures due to severe weather). A useful lesson was to conduct these checks soon after data had been collected, so that the data collection team could easily provide context regarding any identified issues (e.g. unanticipated disruptions to data collection causing lower than expected completion rate; incorrect branching logic in questionnaire causing non-responses to filtered questions), the IT and systems team could be alerted, and solutions identified quickly.
- **Documented Procedures:** Standard operating procedures (SOPs) and detailed workflows ensured consistency across schools and data collection waves. This also helped minimise disruptions due to research team staff turnover.
- **Communicating Clearly and Consistently:** Co-production partners reported confusion when considering the different components of AoW[33], particularly when new studies were added to the programme. Recognising this, we learnt that clear and consistent communication with schools and external researchers was needed to minimise confusion and reinforce the integrity of the AoW programme. Consistency was achieved through including new studies within our regular communication channels between designated AoW recruitment staff and schools. Clarity was promoted by focusing communication on how new studies related to AoW, what additional benefits the new study might have for schools/students, and a clear description of what prospective schools would be asked to do as part of the new study.

7. Responsivity and reciprocity

A clear challenge and directive given by school and community partners was to deliver the AoW programme in a responsive and reciprocal way. Partners wanted to see tangible outcomes from their involvement in AoW, see the research be applied, and see evidence of its potential to benefit adolescent health and wellbeing. An additional challenge was to do so in a timely manner, to maintain trust and engagement of young people, and work together to make a difference.

Key lessons include:

- **Interactive Dashboards:** Schools were provided with data dashboards developed by BiB researchers in consultation with colleagues from the #BeeWell study[20]; these dashboards allowed schools to explore aggregated survey results (topics include mental health outcomes, levels of physical activity, social media use and others), compare outcomes across schools, and identify areas for intervention. These dashboards have been welcomed by school staff and have also aided recruitment, as some prospective schools have signed up for AoW after seeing this tangible benefit of involvement for them and their students.
- **Drop-Down Days:** To reduce the burden of year 9 data collection, which involved questionnaires, motor and cognitive assessments and health measures, AoW introduced drop-down days as an offer to schools. Drop-down days involved taking students off the school timetable for a full day and AoW replacing lessons with a combination of research activities (data collection sessions) and interactive workshops covering topics such as data science and NHS careers. In taking students off the regular timetable and delivering bespoke workshops, the AoW team could help reduce the teaching burden on school staff and free up time for them to support with the administrative and facilitative burden of data collection. These interactive workshops were offered as stand-alone enrichment offers, for schools keen to supplement their offer to students, or schools interested in learning more about the project. Feedback for drop-down days was largely positive and 100% of schools who hosted a drop-down day in year two re-booked another drop-down day for proceeding academic year.
- **Feedback Mechanisms:** Feedback from participants and co-production groups highlighted the importance of regular feedback to those involved in AoW (including parents, study participants, co-production group members and others), including updates on study findings, changes to study designs based on co-production groups' input, and acknowledgement of their contributions. Alongside our data dashboards, other feedback mechanisms included data briefs, video updates, webinars, and social media outputs, whilst participant/co-production group contributions were acknowledged in written outputs and at annual celebration events.

Recommendations for future research studies

Based on the lessons learned from the AoW programme, we present key recommendations in Table 3 for conducting large scale health research in secondary schools. These recommendations are organised into three phases — preparation, implementation, and sustained engagement—each addressing key considerations for researchers. The recommendations emphasise iterative thinking and cyclical working as actions in one phase may inform and prompt adjustment to proceeding and/or preceding phases.

Discussion

The BiB Age of Wonder (AoW) programme offers a unique perspective on the implementation of longitudinal research in secondary schools, particularly within ethnically diverse and socio-economically varied settings. Through three years of active data collection, AoW has navigated the complexities of school-based research, providing valuable insights into the logistical, ethical, and relational challenges faced by researchers. This discussion synthesises the programme's findings, situates them within the broader literature, and explores implications for future research.

Key contributions to longitudinal school-based research

The AoW programme contributes substantially to the growing body of evidence on how to conduct longitudinal research in school settings. Many of the lessons reported in the present paper align with reports from previous school-based research, namely the benefits of co-production and direct input from young people[34–38], the need for operational flexibility and adaptation to foster effective partnerships across different school settings[38–40] and the benefits of adopting opt-out consent for most measures[40]. AoW extends these insights by: (1) describing key lessons within the context of delivering a large-scale research programme with multiple streams of data collection, within a large multi-ethnic population (2) including case studies describing how key lessons were learnt and informed subsequent programme delivery, and (3) translating lessons into practical recommendations to guide future researchers and advance adolescent health research in diverse and complex environments.

Implications for future research

AoW's findings have important implications for researchers seeking to implement longitudinal studies in schools, particularly in diverse and underserved communities.

1. Toward a generalisable framework

AoW's strengths lie in its scale, diversity, and participatory approach. The study has successfully recruited 27 schools thus far, collected comprehensive data from 26 schools on adolescent health, and incorporated the perspectives of young people, parents, and educators. The recommendations proposed in this paper—spanning preparation, implementation, and sustained engagement—offer a roadmap for future studies. By emphasising co-production, ethical practice, operational flexibility, and reciprocity, these recommendations outline the complexities of school-based research while maximising its potential impact.

2. Connecting the system

AoW illustrates how longitudinal research can support translational work across the system – a system comprising schools, students,

Table 3. Recommendations for future research studies, covering preparation, implementation and sustained engagement phases.

Phase 1: Preparation	
1.1 Co-production and Stakeholder Engagement Engaging stakeholders—including students, parents, school staff, the local authority, mental health providers and community leaders—is essential. The co-production approach used in AoW exemplifies how values such as reciprocity, equality, and agency can ensure that research aligns with the needs and priorities of the community.	
1.1.1 Build trust	Researchers should invest time in understanding school contexts, establishing partnerships, and fostering trust with stakeholders including senior leaders, teachers, parents and students.
1.1.2 Engage young people	Engaging young people in co-production activities ensures that study design and processes are relevant, accessible and valued.
1.1.3 Consult and collaborate widely	Input from parents, senior leaders within schools, local authorities and relevant service providers can help refine study protocols and identify potential challenges. This also ensures data is being collected that actively addresses challenges being faced by partners and maximises impact.
1.2 Piloting and Systems Refinement Extensive piloting allows researchers to anticipate and address logistical and technical issues before scaling up.	
1.2.1 Pilot extensively	Include a dedicated and extensive piloting phase (ideally of at least one full academic year) to test survey instruments, consent processes, and logistical workflows across multiple settings.
1.2.2 Simulate real settings	Conduct pilots in a variety of schools (e.g. maintained, independent, multiple academy trusts, varied demographics) to ensure scalability.
1.2.3 Iterate based on feedback	Use pilot data to make iterative improvements to study protocols. Treat each new school as a mini pilot; provide extra time and support and adopt maximum flexibility to learn best method of programme delivery.
1.3 Ethical Protocols Ethical considerations are paramount, especially when working with adolescents. A dual consent model (opt-out for less intrusive measures, opt-in for remaining assessments) offers a practical balance.	
1.3.1 Ensure transparency	Clearly communicate the purpose, benefits, and risks of participation to all stakeholders. Where a dual model of consent is used, ensure these processes are separate and clearly communicated to avoid confusion.
1.3.2 Adapt materials	Provide participant information sheets in multiple languages and formats to improve accessibility.
1.3.3 Consult stakeholders	Be ready to adjust consent models based on feedback from schools and communities.
Phase 2: Implementation	
2.1 Tailored school engagement Each school has unique priorities and capacities, necessitating a flexible approach. Adapting data collection strategies to meet school needs while preserving programme integrity is vital.	
2.1.1 Intelligence gathering	Keeping detailed records on school demographics, key contacts, and learning from previous visits ensure a tailored, clear ask at the most appropriate times.
2.1.2 Provide practical support	Offer resources such as tablets for offline data collection and deliver assemblies to introduce the study to students. Offering incentives to schools (both financial and enrichment opportunities for students) helps to establish a mutual partnership.
2.1.3 Be pragmatic	Recognise schools' time constraints and simplify research activities where possible. Aim for maximum flexibility in the first year (e.g. carrying out a smaller range of activities) and build on this in subsequent years once a partnership has been established. Unforeseen challenges are inevitable, ensure there is sufficient resilience within the team (e.g. training and clear standard operating procedures) to be able to quickly adapt.
2.2 Efficient Data Collection Systems In large-scale studies over repeated time points, accurate systems and processes are essential.	
2.2.1 Schedule a booking meeting	Schedule and confirm research activities with schools well in advance to embed them into school calendars and pre-empt potential disruptions. In subsequent years, aim to have this booked in by the end of the previous school year. Ensure a central booking system is able to capture all necessary detail (such as numbers of staff required, space available).
2.2.2 Be flexible and adaptive	Utilise and invest in technological solutions (e.g. provision of tablets) to offer online and offline modes of data collection and accommodate varying school resources.
2.2.3 Monitor data quality	Implement real-time data checks to identify and address issues such as incomplete responses or technical glitches.

Phase 3 Sustained engagement	
3.1 Reciprocity and Knowledge Translation Returning value to schools, students and broader collaborators (e.g. community groups, local authority partners) strengthens partnerships and enhances the impact of the research.	
3.1.1 Sharing results	Provide schools with aggregated data insights on their school and the broader health landscape; provide insights that can inform policy and practice at a school-level. Provide insights to community and local authority partners to support service delivery and policymaking.
3.1.2 Engaging and upskilling participants	Offer interactive workshops whereby students can explore data for their year group/school/city and learn transferable data science skills. Use workshops to illustrate how the data students provide can contribute to changing policy and practice.
3.2 Maintaining Relationships Strong relationships with schools and relevant stakeholders (e.g. students, parents) are critical for reducing attrition and ensuring future participation.	
3.2.1 Consistent Staffing	Assign dedicated and consistent team members to liaise with schools, building familiarity and trust.
3.2.2 Plan for transitions	Anticipate changes in school leadership or staff and establish strategies to maintain engagement.
3.2.3 Celebrate milestones	Acknowledge and thank schools and students for their contributions through celebratory events, regular feedback channels or public recognition.
3.3 Supporting Additional Studies As research ecosystems expand, external collaborations often arise. While these can enrich the core programme and offer, they must be managed carefully to avoid overburdening schools.	
3.3.1 Set clear boundaries	Define criteria for approving nested studies to ensure alignment with the core research programme.
3.3.2 Coordinate communications	Centralise outreach efforts to prevent conflicting messages to schools.
3.3.3 Prioritise the core programme	Maintain focus on the primary objectives of the core programme.

parents, communities, external researchers and the local authority. This success was almost certainly aided by the pre-existing reputation of Born in Bradford (BiB) as a trusted community research programme and it's existing links with the local authority and service providers. Moreover, just under a third of the AoW target sample are members of the original BiB cohort, and as such have pre-existing familiarity with and trust in BiB and BiB research. However, it's worth noting that even with these existing links to the community, it still took a number of years for AoW to build relationships with secondary schools and fully embed itself into the system. Future researchers should invest ample time and resources in wide stakeholder engagement and partnership-building when looking to initiate and maintain large-scale programmes of research.

3. Addressing underrepresentation in research

AoW highlights the potential of school-based research to include underrepresented groups, such as ethnic minorities and low-income populations. Researchers should prioritise inclusive practices, such as tailoring study materials to cultural contexts and engaging communities in the research process, to ensure that findings are representative and equitable. Strategies to gather data from those students who are absent or don't attend a session (e.g. delivering a Q&A in assembly presentations to alleviate student concerns, scheduling data 'mop-ups' for students who miss initial data collection visits) may prove particularly valuable. Future studies should also consider engaging students not in mainstream schools, such as those in alternative provision settings or home-schooled students.

4. Leveraging technology

The successful use of offline data collection tools in AoW builds on previous work[37,41] in highlighting the potential value of technology in overcoming logistical barriers and engaging adolescents. Moreover, the use of tablet computers for the motor and cognitive assessments further illustrates the capability of technology in permitting scalable and cost-effective research outside laboratory settings. Future studies could explore the use of mobile apps, wearable devices, and real-time data visualisation tools to enhance data collection and participant engagement. The AoW team are aiming to further innovate with the planned post-16 phase of data collection (for young people aged 16–18 years), which will use a central online platform to support consent, questionnaire data collection, health measures and biological sample appointment booking, incentives and communication.

Conclusion

The BiB Age of Wonder programme illustrates the potential of using school settings in longitudinal research to generate actionable insights into adolescent health trajectories, by embracing co-production, ethical engagement, and operational flexibility. The proposed recommendations provide a structured approach for future studies, ensuring that they are inclusive, impactful, and

aligned with the needs of school communities, and ensure studies such as AoW can contribute to the broader goal of improving health outcomes for young people worldwide.

Ethics and consent

The methods described in this paper were reviewed and approved by the Bradford Leeds NHS Research Ethics Committee [Ref: 21/YH/0261, date: 22.12.21]. Written opt-out consent was obtained for all measures, with the exception of blood samples, for which written opt-in consent was obtained. Written informed consent for publication of the participants' details was obtained from the parent/guardian of the participant.

Data and software availability

Underlying data

Researchers are encouraged to make use of BiB data, which are available through a system of managed open access. Before you contact us, please make sure you have read our Guidance for Collaborators. Our BiB Executive reviews proposals on a monthly basis and we will endeavour to respond to your request as soon as possible. You can find out about the different datasets in our Data Dictionary. If you are unsure if we have the data that you need, please contact a member of the BiB team (borninbradford@bthft.nhs.uk).

Once you have formulated your request please complete the 'Expression of Interest' form available here and send to borninbradford@bthft.nhs.uk. If your request is approved we will ask you to sign a Data Sharing Contract and a Data Sharing Agreement, and if your request involves biological samples we will ask you to complete a material transfer agreement.

Extended data

No extended data is included with this article. An AoW data note publication in currently in preparation, thus extended data for reported response rates, participation rates is not included in this instance to ensure it does not preclude publication of the aforementioned data note.

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Born in Bradford is only possible because of the enthusiasm and commitment of the children and parents in BiB. We are grateful to all the participants, health professionals, schools and researchers who have made Born in Bradford happen. Thank you to the BiB Age of Wonder community research assistants and interns who have made this data collection possible.

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The article presents insights from the Born in Bradford Age of Wonder (AoW) study, a large-scale longitudinal cohort research initiative aimed at understanding adolescent health and well-being trajectories within a diverse, multi-ethnic city in the UK.

The study is highly relevant but I have some comments to enhance its methodological rigor

-The justification for the selection of cognitive and motor tasks could be improved. The authors should provide references to validate these measures.
-The paper does not adequately address potential biases in the sampling methodology, especially concerning students who may have opted out, particularly from minorities / underserved populations.
-Would suggest a flowchart summarizing the full research process, from recruitment to data collection to analysis.
-Please discuss potential biases introduced by school selection criteria and how these were mitigated.
-Would expand the discussion to compare findings explicitly to other similar studies and discuss how AoW adds value.
-Importantly more details on the co-production and stakeholder engagement strategies would be beneficial
-Finally a strategy for data synthesis (e.g. how were the findings selected, decided which ones to report etc) would be positive

Is the rationale for developing the new method (or application) clearly explained?
Yes

Is the description of the method technically sound?
Yes

Are sufficient details provided to allow replication of the method development and its use

by others?
Partly

If any results are presented, are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions about the method and its performance adequately supported by the findings presented in the article?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: My area of research is child and adolescent mental health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.