CHILDREN'S ORTHOPAEDICS

The management of idiopathic toe walking

A BRITISH CONSENSUS INFORMING BEST PRACTICE AND CONSISTENT CARE

Y. Gelfer,
A. E. McNee,
J. D. Harris,
J. Mavrotas,
L. Deriu,
J. Cashman,
J. Wright,
A. Kothari,
on behalf of the BSCOS Paediatric Idiopathic Toe Walking Consensus Group

From the British Society For Children's Orthopaedic Surgery, UK

Aims

The aim of this study was to gain a consensus for best practice of the assessment and management of children with idiopathic toe walking (ITW) in order to provide a benchmark for practitioners and guide the best consistent care.

Methods

An established Delphi approach with predetermined steps and degree of agreement based on a standardized protocol was used to determine consensus. The steering group members and Delphi survey participants included members from the British Society of Children's Orthopaedic Surgery (BSCOS) and the Association of Paediatric Chartered Physiotherapists (APCP). The statements included definition, assessment, treatment indications, nonoperative and operative interventions, and outcomes. Descriptive statistics were used for analysis of the Delphi survey results. The AGREE checklist was followed for reporting the results.

Results

A total of 227 participants (54% APCP and 46% BSCOS members) completed the first round, and 222 participants (98%) completed the second round. Out of 54 proposed statements included in the first round Delphi, 17 reached 'consensus in', no statements reached 'consensus out', and 37 reached 'no consensus'. These 37 statements were then discussed, reworded, amalgamated, or deleted before the second round Delphi of 29 statements. A total of 12 statements reached 'consensus in', four 'consensus out', and 13 'no consensus'. In the final consensus meeting, 13 statements were voted upon. Five were accepted, resulting in a total of 31 approved statements.

Conclusion

In the aspects of practice where sufficient evidence is not available, a consensus statement can provide a strong body of opinion that acts as a benchmark for excellence in clinical care. This statement can assist clinicians managing children with ITW to ensure consistent and reliable practice, and reduce geographical variability in practice and outcomes. It will enable those treating ITW to share the published consensus document with both carers and patient groups.

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Introduction

Idiopathic toe walking (ITW) is a common condition affecting up to 5% healthy children aged under ten years.[1] It is a diagnosis of exclusion made when children persist with toe walking for no medical reason beyond the age of two years, the time at which they should have achieved a heel-toe gait. In clinical practice, toe walking is often referred to from the age of two years.[2] Prevalence of persistent toe walking is particularly high in neurodivergent children.[3,4] Children who persistently toe walk can develop contracture of the Achilles tendon, may experience pain, movement difficulties, restriction in school and play activities, and poor emotional wellbeing.[5-8] Non-surgical and surgical interventions are variably used to address impairments and functional limitations associated with ITW with pathways for diagnosis, treatment, and management of this condition debated.[9–11] The literature is limited and does not clearly define best practice.[12,13] Agreement from a small consensus study suggested that

Correspondence should be sent to Y. Gelfer; email: yael.gelfer@stgeorges.nhs.uk

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clinically based measures may enable consistent data collection to support ongoing understanding of the response to intervention in ITW.[14]

In the UK, there is significant variability in treatment philosophy, strategy, pathway of care, and professions involved in the delivery of intervention for ITW. This includes indication for treatment, aims and definition of success, methods including casting, various day and night splints, and surgical interventions.[11] Health professionals across the UK state a need for professional guidance and standards of care in the treatment and management of ITW.[11]

The James Lind Alliance priority setting on lower limb surgery in children identified reducing variations in practice as one of their top 20 priorities,[15] which, along with geographical variation and lack of good evidence, motivated the British Society of Children's Orthopaedic Surgery (BSCOS) to develop consensus statements for selected conditions, one of which being ITW. Consensus methods provide a way of synthesizing information and harnessing the insights of appropriate experts to enable decision-making.[16] The Delphi technique is a structured process that uses a series or rounds of questionnaires to gather information and reach consensus. Since a large number of individuals across diverse locations and areas of expertise can be included anonymously, this method is able to avoid domination of the consensus process by one or a few experts.[15] Several BSCOS consensus statements have been successfully completed in the last few years.[15,17,18] The recognition, dissemination, and implementation will be the key to their success.

The aim of this study was to gain an agreement on the management of ITW by paediatric orthopaedic healthcare practitioners in the UK in order to provide a benchmark for practitioners and guide consistent, high-quality care for children and young people with ITW.

Methods

This study followed a similar protocol of previously published BSCOS consensus statements.[19] Similarly, the AGREE checklist was used as the principle for result reporting.[20] Ethical approval and consent to participate were not needed.

The process included establishing a steering group, steering group meetings, generating statements containing any available literature, a two-round Delphi survey, and the final consensus meeting. The Grading of Recommendations, Assessment, Development and Evaluations (GRADE) scale, which ranges from 1 to 9 (1 to 3, not important; 4 to 6, important but not critical; and 7 to 9, critical for inclusion), was used to score the statements.[21] 'Consensus in' was reached when 75% or more participants scored it as 'critical for inclusion' and less than 25% of participants scored it as 'not important for inclusion'. 'Consensus out' was reached when 75% or more participants scored it as 'not important for inclusion' and less than 25% of participants scored it as 'critical for inclusion', and 'No consensus' was reached when the results did not reach any of other two categories. Data were analyzed once for the whole cohort, followed by analysis for orthopaedic surgeons and for physiotherapists separately (Supplementary Material)

Population. The consensus document applies to all children with ITW of any severity, including children with neurodiversity. It does not apply to patients with neuromuscular conditions.

Members of the steering group were all either representing members of BSCOS or the Association of Paediatric Chartered Physiotherapists (APCP). Applicants for the steering group included both surgeons and physiotherapists who were regularly involved with the management of ITW. Six physiotherapists and six paediatric orthopaedic surgeons were arbitrarily selected from the group of members who submitted an expression of interest for participation in the steering group. None of the steering committee members had any relevant competing interests. The Delphi survey was open to all BSCOS and APCP members with a requirement that the member is regularly involved in treating ITW.

In total, 227 clinicians participated in the first round (54% APCP and 46% BSCOS members) and 222 of those in the second round (98%). The Delphi process questions were close-ended, with an option to comment on every statement.

Target users' preferences and views. The target users are clinical practitioners involved in the management of children with ITW as well as general practitioners (GPs), patient and family groups, and hospital managers involved in planning and budgeting physiotherapy, orthotics, and paediatric orthopaedic clinics. The consensus statements will be shared with families to improve their knowledge and manage their expectations.

Preference of treatment and views on best practice were sought from the literature, where available, expert opinions from practitioners who formed the steering group, and from all BSCOS and APCP members who participated in the Delphi survey. The first steering meeting selected a chair, confirmed the process, and generated statements for the first round of the Delphi survey. Members were allocated for literature searches to support the statements. The second meeting discussed and agreed on the statements for the first round. The statements encompassed ITW definition, initial assessment, treatment decision, and primary (non-surgical) and surgical treatment. The third meeting followed the first-round Delphi. In this meeting, statements reaching 'consensus in' were approved, statements reaching 'consensus out' were removed, and statements that did not reach consensus were discussed, modified when appropriate, and compiled for a second round of grading. The final consensus meeting followed the second round. In the final meeting, statements reaching consensus were approved, and statements not reaching consensus were discussed and voted upon in order to decide whether there was merit in including them. In the case of a statement not reaching consensus by the overall cohort, a breakdown of the votes and comments from physiotherapists and surgeons was reviewed in order to provide more information for decision-making. When that statement was regarding a surgical treatment, the orthopaedic surgeons were permitted the deciding vote and when the statement was regarding primary treatment, the physiotherapists were permitted the deciding vote.

Rigour of development. The relevant topics were scrutinized against the available literature, debated, and discussed in depth during the steering group meetings. The consensus statement is based on the knowledge, practice, and expertise of the participating BSCOS and APCP members.

Table I. The statements that were deleted, modified and voted in during the Delphi process.

Delphi round 2
Deleted
CK is not required as part of ITW primary assessment
Passive ankle dorsiflexion in patients with ITW should be measured in weightbearing using a weightbearing lunge test
Botulinum toxin injection is not indicated in treating ITW
Botulinum toxin injection can be indicated in treating ITW
There is need for follow-up for 24 months after successful treatment
Patients with ITW that have ASD/ADHD should not be considered for the same procedure as they have high recurrence rates
Patients with ITW that have ASD/ADHD should not be considered for the same procedure as have high recurrence rates
There is a need for a follow-up after surgical intervention for 24 months
Modified
ASD/ADHD can coexist with ITW and is not an exclusion to the diagnosis
Initial assessment should always include CK test
Passive ankle dorsiflexion in patients with ITW should be measured in knee flexion and extension in a consistent manner with the heel in neutral position
Joint contracture relevant to ITW gait is loss of any expected dorsiflexion range
Ankle contracture relevant to ITW gait is defined as patient who is unable to dorsiflex to plantigrade
Ankle contracture relevant to ITW gait is defined as patient who is able to dorsiflex to plantigrade and not beyond
Ankle contracture relevant to ITW gait is defined as patient who is able to dorsiflex to 10° of dorsiflexion and not beyond
Ankle contracture relevant to ITW gait is defined as patient who is unable to dorsiflex to plantigrade
Ankle contracture relevant to ITW gait is defined as patient who is able to dorsiflex to plantigrade and not beyond
Ankle contracture relevant to ITW gait is defined as patient who is able to dorsiflex to 10° of dorsiflexion and not beyond
Lower limb pain can be an indication for treating ITW
Psychosocial impact can be an indication for treatment of ITW
Primary treatment can be provided by any trained and experienced health practitioner
Stretching programmes can be provided even if dorsiflexion range allows heel contact in weightbearing
Heel contact should be achieved in weightbearing casts with heel raise to accommodate plantiflexion
Night splints could be provided to maintain range of motion
Failure of treatment is defined as the inability to achieve the shared goal for intervention during an agreed timeframe, e.g. failure to reach plantigrade stance with 6 weeks of casting
Patients with ITW who have ASD/ADHD should be offered treatment with appropriate counselling regarding recurrence rates
Every patient going through surgery should be referred for a gait analysis session in a gait lab
There is a need for a follow-up after surgical intervention for at least 12 months
Final consensus meeting
Modified
Referral for consideration for surgery is indicated when primary treatment was not successful or is inappropriate
Voted in
Asymptomatic ITW without ankle joint contracture does not require treatment
Psychosocial impact can be an indication for treatment of ITW
Night splints could be provided to maintain range of motion
Failure of treatment is defined as the inability to achieve the shared goal for intervention during an agreed timeframe, e.g. failure to reach plantigrade stance with six weeks of casting
Referral for consideration for surgery is indicated when primary treatment was not successful or is inappropriate

ADHD, attention deficit hyperactivity disorder; ASD, autism spectrum disorder; CK, creatine kinase; ITW, idiopathic toe walking.

Results

Steering group meetings and preparations. Four steering group meetings were held throughout the process. Each meeting lasted three to four hours and was held via remote video connection. The first two meetings were held prior to the Delphi survey being sent out for responses, the third followed the first-round Delphi, and the final meeting followed the second-round Delphi.

In the first meeting, a chair was elected and specific topics for inclusion were suggested and agreed by the members. The process of statement development for each topic included a current literature review by members of the steering group, as well as the group members' expert opinion. These were discussed in the second meeting with the list of statements for each topic then included in the round 1 Delphi survey. In the third meeting, following the first round of Delphi, statements reaching 'consensus in' were read and approved, statements reaching 'consensus out' were removed, and statements reaching 'no consensus' were discussed, reassessed, or modified. The list of statements to be presented in round 2 was agreed upon. The final consensus meeting took place following Delphi round 2. Statements reaching 'no consensus' following round 2 were discussed in depth and voted upon to decide whether there was merit in including them. The statements to be included in the consensus document were finalized. The timeline for the process included six weeks for each round of Delphi survey,

Table II. Summary of consensus statements at every stage.

Clinical role	n
Steering group	
Total statements	54
Delphi round 1	
Total statements	54
Statements reached 'consensus in'	17
Statements reached 'consensus out'	0
Statements reached 'no consensus'	37
Delphi round 2	
Total statements	29
Statements reached 'consensus in'	12
Statements reached 'consensus out'	4
Statements reached 'no consensus'	13
Final consensus meeting	
Total statements	14*
Statements 'voted in'	5
Statements 'voted out'	9
Final number of statements in the consensus document	33

*Statement 42 reached consensus in round 2; however, it was submitted to the final consensus meeting for alteration.

two to three weeks to analyze the data after each round, and two weeks for the statements from each meeting to be documented by the chair, disseminated to the steering group members, and approved before proceeding to the next stage. The overall timeline was from 4 May 2023 to 18 January 2024.

Round 1 Delphi survey. In total, 54 statements were included in Delphi round 1. Of these, 17 statements reached 'consensus in' and were included in the final statement after approval by the steering group. No statements reached 'consensus out' for the entire cohort; 37 statements reached 'no consensus' and were discussed in the steering group meeting.

During the meeting that followed round 1, eight statements were deleted (statements 6, 10, 30, 31, 35, 41, 48, and 53 in Supplementary Table i), nine statements were included in round 2 as they were (statements 18, 19, 29, 33, 34, 42, 43, 49, and 50 in Supplementary Table i), and 20 statements were reworded or rephrased based on the comments received from round 1 and were added to round 2 (statements 2, 5, 9, 20, 11 to 17, 21, 24, 25, 27, 28, 37, 40, 51, and 52 in Supplementary Table i). The total number of statements presented to round 2 was 29.

The descriptive analysis of all statements in the Delphi survey round 1, including the median and IQRs, is presented in Supplementary Table i.

Round 2 Delphi survey. A total of 29 statements were included in Delphi round 2. The voting participants were able to see the percentage agreement that each statement had reached in round 1.

Overall, 12 statements reached 'consensus in', four statements reached 'consensus out', and 13 statements reached 'no consensus' and were voted upon in the final consensus meeting. The descriptive analysis of all statements in the Delphi survey round 2, including the median and IQR, is presented in Supplementary Table ii.

The final consensus meeting. In the final consensus meeting, all the statements that reached consensus during the Delphi survey were approved. Four statements were rephrased (2, 18, 21, and 42), two statements were amalgamated (12 and 15) and two statements were deleted as they became redundant after the other statements were approved (13 and 16). The overall number of statements which were voted upon was 13. Five statements were voted 'in' and eight were voted 'out'. The statements that were deleted, modified and voted in during the Delphi process are presented in Table I. The number of statements and their status at each stage is shown in Table II.

The final consensus document includes five sections, and 31 statements (Table III).

Discussion

Current management of ITW shows significant variability in practice across the UK, from referral pathways, through primary assessment and treatment options to outcome measures.[10,11] The literature suggests physiotherapy intervention is indicated for the physical functional, emotional, and/or social effects of ITW, but there is little evidence to support intervention benefits.[5,11] The indications for and outcomes of orthopaedic surgery vary between surgeons. Casting and orthotics are variably used without clear indication. The purpose of creating a consensus statement for management of children with ITW is to improve the overall level of care and outcomes for this group, and guide practitioners treating this condition.

We present the result of a complete consensus document using the Delphi process. The consensus includes an overall approach to managing the journey of children and young people with ITW and their families. It incorporates basic definitions, referral process and primary triage, identification of the most appropriate treating practitioner, and requirements for further diagnostics. Specific indications for primary and surgical treatments are presented, together with treatment adjuncts, outcome measures, and follow-up timing. The process emphasized areas of paucity in research, areas of specific importance to BSCOS and APCP members, and the need for a holistic approach to the management of this condition.

The external reviewers of this document are the BSCOS and APCP bodies. To improve statement quality, applicability, and feasibility, the steering group provided robust and detailed feedback throughout the Delphi process. With the two professional groups offering different approaches to ITW management, invariably there was a difference in perspective on some statements. These were debated and discussed within the steering group, with every statement reaching a final consensus. There was a robust protocol to follow that included cases of statements reaching a 6:6 vote in the final consensus meeting. The agreement was that if that scenario occurs, the professional body most involved with the particular statement would have the final vote. This was implemented in statement 10 in the final consensus statement (Table III), when the APCP members had the deciding vote to include this statement.

Toe walkers may have a contracture of the Achilles tendon, resulting in limited range of motion of the ankle; however, many children with ITW have no contracture.[1,9] The normal ankle range of motion for developing children during the gait cycle is from 25° of dorsiflexion to 15° to 20° of plantar flexion.[22] The threshold of what range of ankle dorsiflexion is normal or requires treatment at each age was one area of debate, although with the evidence being less clear than one would expect.[23]

Table III. The final consensus statements.

Definition
ITW is defined as bilateral toe walking that started from initiation of walking and is not associated with any known neurological condition, and persistent beyond the age of two
Neurodiversity (ASD/ADHD) can coexist with ITW and is not an exclusion to the diagnosis
Initial assessment
Every referral of ITW should first be seen by an experienced practitioner who can assess, identify, diagnose, and refer to a developmental paediatrician/paediatric neurologist when appropriate
Assessment should involve family history, developmental history, and basic musculoskeletal and neurological examinations including range, strength, and gait
In the case of any abnormal/positive findings in the neurological examination, a referral should be made to the appropriate specialist with consideration of further diagnostic tests and imaging
Treatment decision
Passive ankle dorsiflexion in patients with ITW should be measured in knee flexion and extension in a consistent manner with the heel in a neutral position
Ankle contracture relevant to ITW gait is defined as a patient who is unable to dorsiflex to plantigrade
The aim of primary treatment is not solely to address toe walking but to manage the symptoms affecting the child who toe walks
Lower limb pain can be an indication for treating ITW
Psychosocial impact can be an indication for treatment of ITW
Asymptomatic ITW without ankle joint contracture does not require treatment
Primary treatment
Primary treatment can be provided by any trained and experienced health practitioner
Non-surgical treatment should always be the first choice of treatment
Stretching programmes can be provided even if dorsiflexion range allows heel contact in weightbearing
Primary treatment includes education and advice, stretching, strengthening, casting, and day and night splints as decided by the treating health practitioner based on the clinical examination
Serial casting can be attempted to reduce equinus contractures
Heel contact should be achieved in weightbearing casts with heel raise to accommodate plantarflexion
Night splints could be provided to maintain range of motion
The aim of treatment is to address the indication/ symptom and hence the outcome of the treatment would be whether that goal was achieved
Failure of treatment is defined as the inability to achieve the shared goal for intervention during an agreed timeframe, e.g. failure to reach plantigrade stance with six weeks of casting
There is no need for follow-up after successful primary treatment and patients could be re-referred if needed
Following discharge from primary treatment, patients and families should be advised regarding potential risk factors for recurrence of ITW and how to seek re-referral into services if needed
Recurrence of ITW is defined as ITW that was previously treated successfully and has now lost that improvement in symptoms (range, pain, etc)
In the case of recurrence following a successful intervention, there is room for another attempt in primary treatment
Neurodiverse patients with ITW should be offered treatment with appropriate counselling regarding recurrence rates
Surgical treatment
Referral for consideration for surgery is indicated when primary treatment was not successful or is inappropriate
Carers should be involved in the treatment decision-making
Decision of surgery type (Hoke/Open/Gastrocnemius) should be made by the operating surgeon based on the clinical findings
If other structures need addressing in surgery (e.g. plantar fascia or flexors) it can be added to the procedure
There is a need for a follow-up after surgical intervention for at least 12 months
Outcomes should be measured and documented after any intervention

ADHD, attention deficit hyperactivity disorder; ASD, autism spectrum disorder; ITW, idiopathic toe walking.

Furthermore, there was much debate on how such contracture should be assessed and whether a static assessment was comparable to the "squat" or "lunge test"[24] in the assessment of the functional range of ankle dorsiflexion.

The more philosophical question of what constitutes treatment of toe walking was another topic to be clarified between those groups who viewed this only as physical intervention versus those who might "treat" a younger or less affected patient with attention to education and improved understanding. An example of one area of debate include indication for treatment due to psychosocial impact. Although this was not considered a priority for surgeons, physiotherapists favoured inclusion. This process of refinement has produced a document that reflects the understanding and philosophy of both professional groups. It is these differences of opinion, usually where conclusive evidence is lacking, that highlight areas where further research should be considered.

The strengths of the study are the vigorous design, meticulous implementation of the protocol, and thorough interpretation of the results. The steering committee participants are from across different parts of UK with equal representation from physiotherapists and orthopaedic surgeons, and both professional bodies. There was a very low dropout rate in respondents (2%). It is this collaboration between the two groups that provides a unique insight into the consensus throughout those professionals managing children affected by toe walking. However, as only British practitioners were involved, the results are more appropriate for a British health system.

Information regarding barriers and facilitators to implementing the statements was sought through offered opinions during the Delphi process and in steering group meetings. The barriers were identified when narrowing the indications to primary interventions due to overlapping presentations, and agreement on the aim and or 'endpoint' of intervention. These barriers did not influence the guideline development process or formation of the recommendations. The barriers were discussed thoroughly in the meetings.

The magnitude of benefit versus harm was considered. The benefits of publishing a consensus statement include improving quality of care, consistency in treatment, and better information for patients and families. Provision of a benchmark will facilitate service setup, training, and audit across the UK. The statement will be disseminated to GPs, parents' and practitioners' groups, and will be the expected standard of care in every hospital and community clinic in the UK. However, when the recommended standard of care is not available to families in their local area there is potential for harm. While geographical variability in intervention is a reality, it will not be exacerbated by this exercise. The consensus will allow families to be better informed and learn what to expect. It is believed the resulted benefits outweigh the potential side effects.

The steering group used evidence from the literature, where available, to support each subject. However, not all individual statements have high-quality supportive evidence. Indeed, the literature highlights large variability in all aspects of triage and practice reflected in inconsistent outcomes and outcome collection. We have used evidence-based statements when available, as well as statements based upon the best practice of a representative group of experienced clinicians with an established practice. The recommendations are based on both consensus opinion and the available literature.

This consensus should be audited and revisited in five years with a view to include an update or addendum if needed.

The consensus document should be available in a laminated version in physiotherapy, orthopaedic, and paediatric clinics, with a printed version available for patients and families.

It is recommended that adherence to the consensus should be audited regularly, and prospective data collection of the outcomes collected to assess the impact.

This consensus document does not include a cost analysis, however the consensus statement does not add any obvious new burden on resources. This consensus statement has a high applicability to practice context. It provides specific information divided into three sequential stages including definitions, referral pathways, primary assessment, primary treatment, and surgical treatment including adjunct treatment, outcome collection, and follow-up.

In conclusion, this consensus statement was achieved following the Delphi process. It is now the recommended process for assessment and management of ITW, and aims to reduce regional variability in treatment and improve outcomes. Adherence with regular auditing will affirm its implementation.

Take home message

- This aim of thid study was to gain a consensus for best practice of the assessment and management of children with idiopathic toe walking (ITW).
- This statement can assist clinicians managing children with ITW to ensure consistent and reliable practice, and reduce geographical variability in practice and outcomes.

Social media

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Follow L. Deriu on X @laura_deriu
Follow J. Wright on X @jwrightortho
Follow A. Kothari on X @AlpesKothari

Supplementary material

The supplementary material include the descriptive analysis of statements included in the Delphi survey rounds 1 and 2.

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Author information:
Y. Gelfer, BSc, MD, PhD, FRCS, Consultant Paediatric Orthopaedic Surgeon, St George's University Hospitals NHS Foundation Trust, London, UK; St George's University of London, London, UK.

A. E. McNee, Physiotherapist, Chelsea and Westminster Hospital, London, UK.

J. D. Harris, Physiotherapist, Chesterfield Royal Hospitals NHS Foundation Trust, Calow, UK.

J. Mavrotas, MB BChir MA (Cantab), MRCS, Health Education England North West School of Surgery, Manchester, UK.

L. Deriu, MD, PhD, Consultant Paediatric Orthopaedic Surgeon, Leeds Teaching Hospital Trust, Leeds, UK.

J. Cashman, FRCS, Consultant Paediatric Orthopaedic Surgeon, Sheffield's Children's Hospital, Sheffield, UK.

J. Wright, MBBS, BSc, FRCS (Tr&Orth), Consultant Paediatric Orthopaedic Surgeon, Royal National Orthopaedic Hospital, Stanmore, UK.

A. Kothari, MA, BM BCh, AFHEA, MSc, DPhil, FRCS (Tr&Orth), Consultant Paediatric Orthopaedic Surgeon, Oxford University Hospitals NHS Foundation Trust, Oxford, UK.

Author contributions:
Y. Gelfer: Methodology, Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Project administration, Supervision.
A. E. McNee: Investigation, Writing – original draft, Writing – review & editing, Data curation.
J. D. Harris: Data curation, Investigation, Project administration, Writing – original draft, Writing – review & editing.
J. Mavrotas: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Writing – review & editing.
L. Deriu: Data curation, Investigation, Supervision, Writing – review & editing.
J. Cashman: Conceptualization, Data curation, Investigation, Supervision, Writing – review & editing.
J. Wright: Data curation, Investigation, Validation, Writing – review & editing.
A. Kothari: Conceptualization, Data curation, Investigation, Methodology, Resources, Supervision, Writing – review & editing.

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