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Return-to-Learn for the K-12 Student: a Mixed-Methods Systematic Review

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Abstract

Objective: Our aim was to perform a systematic review of Return-to-Learn literature with the intent of determining what items are necessary to form a comprehensive Return-to-Learn policy.

Data Sources: We searched CINAHL, Embase, PubMed, Scopus, Google Scholar, and WorldWideScience.org using 25 search terms including *return to learn, adolescents, concussion management, concussion AND children, concussion AND department of education, concussion AND secondary schools, concussion AND middle school, concussion AND primary school, concussion AND policy AND procedures, concussion AND 504 plans*.

Study Selection: Eligible studies were (i) published between 2009 and 2022; (ii) originally published in English in a peer-reviewed journal; (iii) have a full text available; (iv) discuss the K-12 population; (v) contain one of the following terms in the body of the document: Return to Learn, RTL, Return to School, Return to Classroom, or Return to Academics; (vi) identify RTL as a primary aim of the document.

Data Extraction: The Qualitative Assessment and Review Instrument and JBI Meta-Analysis of Statistics Assessment and Review Instrument tools were used to extract data from eligible studies. Extraction occurred independently by two researchers.

Data Synthesis: Review yielded 32,766 articles, with 58 meeting inclusion criteria. Two qualitative themes and five subthemes aggregated with six quantitative narratives to produce five converged findings: 1) members and point person, 2) overcoming barriers to communication, 3) increasing concussion knowledge and training in the school system, 4) recommendations in the classroom, and 5) tackling the invisible injury.

Conclusions: Less than one-third of included articles reported data from younger (K-8) cohorts, therefore, the converged findings represent significant facets of high school Return-to-Learn that stakeholders should embed into novel and revised state concussion legislation. Subsequent efforts should seek to appraise current state Return-to-Learn laws for existing use of evidence-based practice and begin accumulating data specific to younger students and school

professionals that monitor and teach these individuals such that commensurate policy recommendations can then be made.

Key Words: Brain Concussion, Return to School, Faculty, Education, Health Services for Persons with Disabilities

Abstract Word Count: 278

Manuscript Word Count: 5,144

Key Points:

- The current review surpasses previous systematic reviews on this topic, with more articles screened, and utilization of a standardized technique for mixed-method data extraction and analysis.
- These findings should be used by state legislators and stakeholders when forming or revising return-to-learn laws.

Introduction

Concussions are recognized as a major health concern because of their negative effect on brain function, leading to immediate and potential long-term health problems.[1] In the adolescent population these injuries have the potential to disrupt brain development, resulting in altered health, cognition, learning, self-regulation, social skills, and other factors important in their transition to adulthood.[1] While initially under-researched, attention towards school reintegration and a smooth transition back to the classroom following concussion has morphed into a critical component of post-concussion care. In fact, several groups suggest that a student should successfully complete a return-to-learn (RTL) progression prior to returning to sport without restrictions.[2–5]

Implementation of a RTL protocol may promote academic accommodations in a timely manner, yet RTL is often neglected at school administrative levels.[5] In a review by Thompson et al., 75% of states had no statewide concussion policy nor did they require schools to produce a written RTL plan, which demonstrates the need for additional statewide efforts.[6] Protocols that are in existence display variability with whom they educate (i.e. administrators, teachers, school nurses), as well as the students they serve (i.e. student-athlete vs. non-athlete).[6] Legislation provides the potential to improve the management of concussions, which can be seen through the transformation of return-to-play protocols and nationwide adoption of the Lysted Law.[7] Though RTL protocols have been developed in some educational settings, most school professionals, healthcare providers, parents, and students lack the appropriate knowledge and understanding of these policies or their existence.[8] In a study of teachers and instructional aides, 80% reported feeling the need for additional information regarding what to do if a student experiences a concussion (n=130).[9] Similarly, DeMatteo et al. found that only 27% of primary care physicians were providing RTL protocols, compared to 51% of the physicians sharing return-to-play protocols with their patients.[10] Thus, improvements can be made to, at minimum, equalize the distribution of RTL with return-to-play information.

Current literature highlights multiple RTL inadequacies, with several gaps stemming from a dearth of understanding about concussion management. Furthermore, systematic review reports that schools should have a concussion policy in-use, with concussion education available for school personnel, students, and parents.[11] More states, and by extension schools, will expectedly adopt RTL policies; however, legislators and school administrators will expectedly require guidance to ensure effective measures are included. Therefore, the aim of this systematic review was to perform a thorough appraisal of RTL literature with the intent of determining what items are necessary to form a comprehensive RTL policy.

Methods

Study Design

The current review utilized a Joanna Briggs Institute (JBI) methodology for mixed methods systematic review. Specifically, our research question was formed using a Population-Exposure-Comparison-Outcome (PECO) framework (Table 1) and a convergent segregated approach to data extraction, synthesis, and integration.[12] Article screening followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart.[13]

Table 1. PECO Framework

			Rationale
P	Population	K-12 education	These educational settings have implemented, revised, or are in the process of formulating RTL policies, which may or may not be required by state law.
E	Exposure	Concussion	Temporary disability of interest.
C	Comparison	Qualitative and quantitative data	Both data types must be appraised to formulate a comprehensive conclusion.
O	Outcome	The necessary components to a RTL policy	Findings will inform legislators, school administrators, and policy makers who are tasked with establishing RTL guidance.

Keywords, Search Terms, and Databases

Keywords, found in Table 2, were combined to form preliminary search terms by combining related keywords. A limited search of PubMed and CINAHL was conducted to create a standardized set of useful search terms (Table 3).

Six databases were chosen as they commonly include literature from health disciplines (Embase, PubMed), a combination of disciplines (CINAHL, Scopus), or house a variety of gray literature (Google Scholar, WorldWideScience.org). Hand searching of reference lists for relevant studies identified additional documents. The standardized search strategy for each database is shown in Figure 1 and took place in the Fall of 2022.

Study Selection

Databases were searched using the following automated filters (i) published between 2009 and 2022; (ii) originally published in English; and (iii) have a full text available. Resulting documents underwent an initial screening. Documents were excluded if they (i) were not published in a peer-reviewed journal; and (ii) were duplicates. A secondary screening followed and ensured that documents (i) discussed the K-12 population; (ii) contained one of the following terms in the body of the document: Return to Learn, RTL, Return to School, Return to Classroom, or Return to Academics, and (iii) identified RTL as a primary aim of the document. Eligibility of articles was independently determined by two authors (MD, SG), with a third author (ZB) adjudicating any disagreements. For full details of the screening process please reference Figure 1.

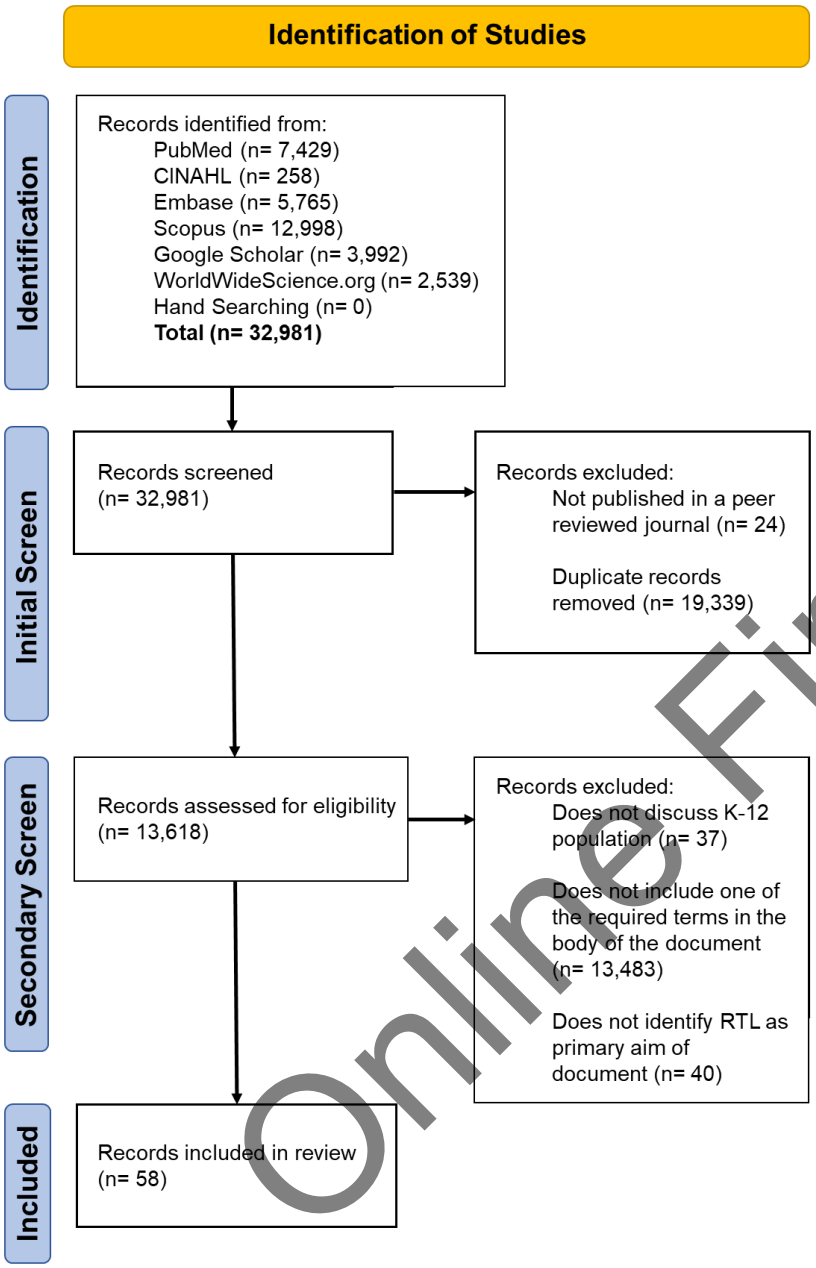

Figure 1. PRISMA Flowchart

Data Extraction

Independent data extraction was performed by two authors (MD, SG). Authors then rejoined to review and reach agreement. A third author (ZB) adjudicated any disagreements. Because both qualitative and quantitative articles were anticipated, specificity of tool was necessary. The JBI Qualitative Assessment and Review

Instrument (QARI)[12] was the best fit for all qualitative articles (Figure 2). Quantitative data was handled with the JBI Meta-Analysis of Statistics Assessment and Review Instrument (MAStARI) (Figure 3). This tool is used for any quantitative data extraction purposes, not meta-analyses alone.[12] For documents that do not follow traditional original research manuscript format (i.e. opinion manuscripts, short commentaries, etc.), the best fitting JBI tool was applied to extract data.[12]

Data Synthesis and Convergence

Qualitative and quantitative evidence examine different aspects of our study aim, meaning a convergent segregated approach to data synthesis and convergence was indicated. For example, qualitative data may review variations between RTL recommendations (e.g. personnel included, description of their role, communication processes, etc.), while quantitative data can speak to the prevalence of current practices (e.g. percentage of teachers who have received concussion education, percentage of healthcare providers who provide RTL instructions, etc.). Together, both can share information on the overall comprehensiveness of an RTL policy. This approach begins by conducting a segregated or separate synthesis for both the quantitative and qualitative data. This is followed by an integration or convergence of the results derived from each synthesis. While there is no preferred order in which synthesis should occur (quantitative then qualitative, or vice versa), both must be complete before convergence occurs.

Qualitative Data Synthesis

The process began by following a meta-aggregative approach. Data synthesis of this fashion aims to inform decision-making, answer a specific practice question, and summarize views; making it readily usable at the clinical level or policy level.[14] Meta-aggregation begins with identifying and assigning labels (i.e. codes) to meaningful findings from qualitative studies.[14] These *codes* are then consolidated into a *synthesized finding*, which embodies the overarching description of the codes. This process is

repeated until all codes are accounted for and a set of synthesized findings are created.

Quantitative Data Synthesis

Meta-analyses are the preferred method for synthesizing quantitative data within a systematic review; however, JBI identifies this approach as inappropriate if enough methodological or study design heterogeneity is encountered.[12] Instead, JBI recommends quantitative data be connected into a coherent whole, taking the form of a quantitative narrative. Our quantitative documents lacked homogeneity, therefore quantitative narratives were formed.

Convergence

The segregated design involves convergence of evidence through a method known as *configuration*. Configuration is the arrangement of complementary evidence into a line of argument. Because the quantitative and qualitative evidence address different dimensions of our study aim, the data can neither confirm nor refute each other, but rather they shape each other.[12] Authors (MD, SG) considered how the results complemented each other by using one type of evidence to explore, contextualize, or explain the findings of other types of evidence. In some cases, results may not be complementary or have a relationship, thus identifying gaps for future research to fill. An iterative configuration process continued until summative results were agreed upon by the authors (MD, SG, ZB).

Assessment of Methodological Quality

Quantitative

JBI offers a gamut of critical appraisal tools, each tailored to examine a given study design.[12] This allowed for specificity of analysis. Critical appraisal for all articles followed a matching format in that questions were answered with either ‘yes’, ‘no’, ‘unclear’, or ‘not applicable’ responses, with a greater number of ‘yes’ responses indicating better methodological quality. A sample critical appraisal tool can be seen in Figure 4.

Qualitative

Qualitative articles underwent additional assessment using the ConQual tool, which systematically scores the dependability of each article that contributed data, and the credibility of that data.[15] Each piece of data extracted from an article formed an 'article-data pair', and was assigned an initial ranking of 'high' if it originated from a qualitative study, with article-data pairs from commentary or opinion papers ranking 'low" (scale: high, moderate, low, very low). From there, questions regarding methodology will adjust the pairs' overall ranking (see Figure 5A for dependability scoring). In a similar fashion, the data provided by the article to support a synthesized finding is subjected to a credibility ranking. Again, the outcome will adjust the pairs' overall ranking (see Figure 5B for credibility scoring). The result of both rounds is a ranking that, along with other article-data pairs, reflects the confidence of a synthesized finding. Refer to Figure 5C for a full example ConQual scoring (dependability + credibility).

Results

Study Selection

A search of six databases yielded 32,766 articles. Endnote excluded exact duplicates (n=19,124) with a third author adjudicating the exclusion of 24 additional articles that were not peer-reviewed. The absence of keywords excluded 13,482 articles, with 37 excluded for not discussing the K-12 population, and 40 excluded for RTL not representing a primary focus of the article. Ultimately, 58 articles met inclusion criteria. Full details of the screening process can be seen in Figure 1.

Study Characteristics

Summary of the included articles can be found in Table 4, with qualitative (n=33), quantitative (n=20), and mixed-method (n=5) research represented. Study designs included commentary (n=7); narrative review (n=9); collaborative model case study (n=1); semi-structured interviews (n=4); scoping review (n=3); systematic review (n=5); clinical report (n=1); focus groups (n=2); pre-post design (n=3); follow-up phone interviews (n=1); prospective cohort (n=5); cross-

sectional (n=7); randomized comparative effectiveness trial (n=1); mixed-method questionnaire (n=1); and mixed-method survey (n=2); literature review (n=3); book chapter (n=1); viewpoint (n=1); online questionnaire (n=1). Articles often surveyed teacher's knowledge of concussion and RTL (n=4), K-12 students with concussions (n=17), school nurses (n=7), athletic trainers and their role in RTL (n=3), and school administrator understanding of concussion and RTL (n=3). Finally, articles reviewed or commented on RTL for K-12 as a whole (n=31), aggregated data from stakeholders (n=8) and students (n=9) across K-12, or collected data from high school stakeholders (n=7) and students (n=3) specifically. No articles reported on elementary or middle school staff or students individually.

Qualitative Findings

Thirty-three qualitative articles gave way to eight codes, 13 synthesized findings, two themes, and five subthemes. Refer to Figure 6 (left side) for full details of the qualitative data synthesis. The theme of *The Return to Learn Team* was composed of two subthemes, 1) *Members of the RTL Team and the Point Person,* and 2) *Barriers to Facilitating Open Channels of Communication*. Subtheme 1 was highlighted throughout all articles, emphasizing the need for a multidisciplinary RTL team:

> "a team-based approach is best, with collaboration between the student and family, healthcare professionals and school staff".[16]

Similarly, the need for a point person when returning a student to the classroom was stressed:

> "It would be helpful for the pediatrician if the school could identify a 'point person' or case manager to contact at the school and likewise for the school to be given a 'point person' in the pediatrician's office."[17]

Subtheme 2 focused on the current obstacles preventing streamlined communication between all parties of the RTL team. This is seen particularly in communication with parents:

> "To facilitate these discussions, school professionals reported the need to use a variety of information formats to reach parents with messages about their child."[18]

> "Respondents [pediatricians] indicated it was difficult to find time during their already busy schedule to contact schools, and when they did they were often unsure of whom to contact."[19]

Together, these illustrations display some of the barriers to facilitating open channels of communication that individuals are confronted with during the RTL process.

The second theme of *Education* was composed of three subthemes, 3) *Lack of Training and Concussion Knowledge in the School System*, 4) *Utilization of Return to School Protocols*, and 5) *Difficulties with an Invisible Injury*. Subtheme 3 was identified extensively in the included articles. Students articulated:

> "Well, some of my teachers weren't sure how to help me… he was kind of unsure how I would be able to take tests"[20]

> "From the school's perspective, they're not concussion experts at all… the teachers are trying to be accommodating, but they also are not concussion experts and they don't know exactly how to do it."[20]

Gioia[23] addresses the current lack of training by identifying specific solutions:

> "educating school personnel about (1) concussions and their effects, and (2) each professional's role in management when an injury occurs."[21]

Subtheme 4 is focused on the idea that sample stepwise RTL protocols have been developed, but may not fit the desired population or are simply not being used in practice. DeMatteo et al.[22] describes:

> "(1) existing consensus-based adult protocols are not appropriate for children, (2) more conservative protocols were needed for children, and (3) protocols for children must include return to *all* activity, including sport and school."[22]

Subtheme 5 captures the unique struggles of concussion lacking outward visibility. Students expressed their concern, saying:

> "Yeah, just for them [teachers] to understand better. It's hard because concussions aren't like a broken arm. You don't have a cast. No one can see it, so then nobody knows when it's actually healed."[20]

School professionals similarly expressed:

> "teachers, school nurses, psychologists, and counselors shared a universal concern about the challenge of identifying a concussion as it is an 'invisible injury' and a student may experience multiple symptoms common with other conditions."[18]

From this, we can appreciate the challenges that accompany concussion, and how school personnel struggle to assist students.

Quantitative Findings

Data synthesis gave way to six narratives (Figure 6, right side). They are 1) *Return-to-Learn Team*, 2) *Communication,* 3) *Lack of Education,* 4) *Recommendations for School Accommodations*, 5) *Return-to-Learn Policy*, 6) *Concussion Symptom Timeline.*

Three articles contributed to narrative 1, which identifies the different members of a RTL team.

> Student support teams comprising academic, medical, and family representatives are unanimously recommended (100%),[23] but few designate a RTL team leader (21-56%), [23] with even fewer laws requiring one (25%)[6]. Athletic trainers are frequently identified as the point person for managing a student-athlete's health status (73.7%) and academic progression (35.5%),[23] with school counselors and nurses next in line (17.2%, 11.9%).[23] On the other hand, with most high schools having access to a school nurse comfortable in concussion management (95%),[24] school nurses are also identified as a team leader 31.3-51% of the time.[25]

Three articles contributed to narrative 2, which outlined the importance of communication within a RTL protocol:

> While athletic trainers report communicating often or always with the high school athletic directors (72.1%)[23] and school nurses (65.3%),[23] there is a greater lack of standardized

communication from individuals outside the school community. Most often, the concussion is self-reported by the student (50%), followed by the athletic trainer (38%), parent (15%), medical provider (3%), and school staff (3%).[26] Nurses (73%)[27] indicated a greater need for direct communication with the medical provider that diagnosed the concussion, but currently are contacted more often by the parents of the student (67% vs. 42%),[27] while school counselors and psychologists requested more communication in general (57.7% and 61.3%, respectively)[23].

Five articles contributed to narrative 3, which discussed the limited understanding of concussion symptoms and confidence when managing students:

Formal training regarding concussion management is infrequently (30-66%)[9,24,28] and inadequately (38%, 19%)[27] provided to teachers and high school principals, respectively. While teachers could correctly identify common concussion symptoms like headaches, trouble concentrating, and trouble with memory (95.4%, 86.2%, 82.3%, respectively),[9] there is a general lack of confidence among educators when managing a student who had suffered a concussion (4.6% extremely confident, 17.7% very confident, 62% somewhat comfortable).[9,24] However, when provided with educational materials, as requested by many teachers (56.7-82%)[9] and nurses (58%)[27], there was an increase in both educator knowledge of concussion (80%)[22] and confidence of treating concussed students (85%).[22]

Six articles contributed to narrative 4, which describes the various recommendations in which schools should implement:

RTL accommodations are inconsistently recommended (14-70%),[29] with females and PPCS patients receiving RTL recommendations more often (3-fold likelihood and 17% greater frequency, respectively).[30,31] The mean number of accommodations provided to students varies (2.3-9.8),[31,32] with longer time to complete tests, postponed schoolwork, partial days, and rest breaks prescribed most often (86%, 82.7%, 77.6%, and 80.2%,

respectively[2,3]; however, such detailed instructions are not consistently recommended by providers (2-94%).[31]

Six articles contributed to narrative 5, which highlights the implementation of a RTL policy:

The presence of formal RTL policies in high schools is scarce (12-43.7%),[27,33,34] with school districts also lacking formal guidelines to assist concussed students during the RTL process (47-70%).[31,33] The shortage of RTL policies may be a result of the few (16%)[6] unevenly distributed (50% northeast)[6] and unstandardized (50%)[8] RTL laws that are often exclusive to student-athletes (~50%).[6]

Four articles contributed to narrative 6, which highlighted timelines for concussion symptoms, symptom profiles, and level of school difficulty:

Students report an average of nine symptoms, a total symptom severity of 24, and are often symptom free in 2-4 weeks with the presence of a RTL plan (2 weeks = 45%, 3 weeks = 34%, 4 weeks = 21%).[32,35] A variety of symptom profiles exist for predicting the level of school difficulty post-concussion, such as subscale (cognitive/balance) scores, a greater number of symptoms, and greater severity of symptoms (40% vs.12%, 9.5-13.6 vs 6.2-11.6, and 40.5 vs.29.7, respectively).[32,35] The presence of unique symptoms like amnesia (1.8-fold likelihood)[35,36] and blurred vision (2.5-fold likelihood)[36] contribute to the number of students reporting academic difficulty following a concussion (29-64%)[35,37] and prolonged symptom resolution (>1mo. 56%).[35]

Data Convergence

Juxtaposition of our data revealed that quantitative narratives complemented qualitative themes; thus, the following convergences ensued: subtheme 1 with narrative 1; subtheme 2 with narrative 2; subtheme 3 with narrative 3; subtheme 4 with narratives 4, 5, and 6; subtheme 6 with narrative 3. These five groupings produced the following sets of converged data: 1) Members and Point Person, 2) Overcoming Barriers to Communication, 3) Increasing

Concussion Knowledge and Training in the School System, 4) Recommendations in the Classroom, and 5) Tackling the Invisible Injury (Figure 6, middle).

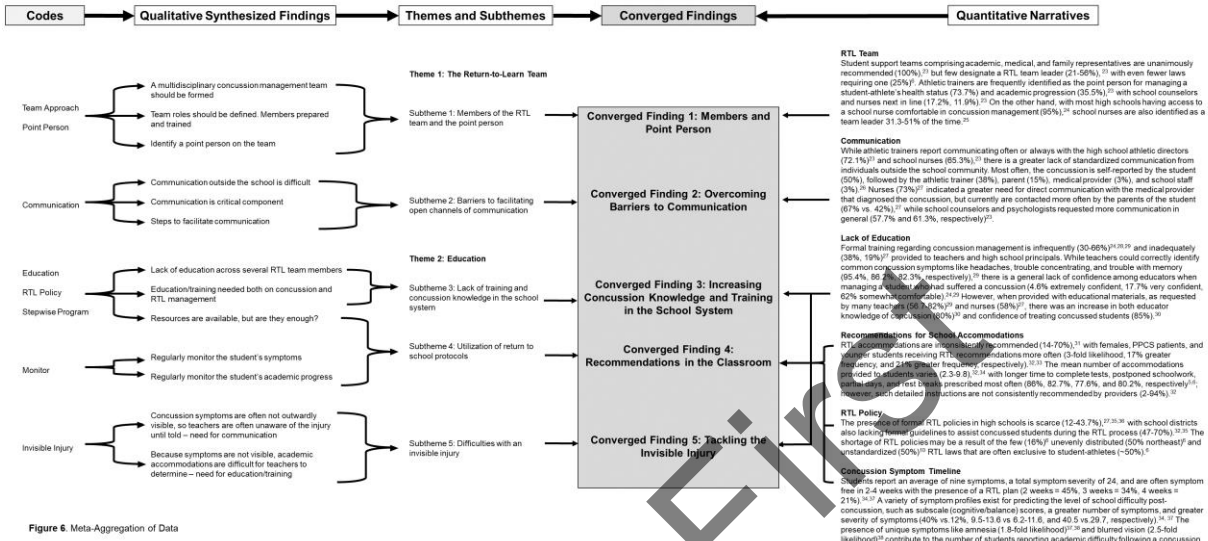

Figure 6. Meta-Aggregation of Data

Elementary, Middle, and High School Data

Twenty-eight of the 58 articles presented data on specific RTL members (i.e., nurses, students, parents, etc.), with the majority (18/28) reporting on multiple members within a single investigation.

Combined Elementary, Middle, and High School Student Data

Nine articles discuss aggregated student data,[29,30,35–41] though only four separate their findings by age, and to varying degrees. Arbogast showed that students aged 12-14 are more likely to receive vestibular-ocular examination (1.18 OR) and RTL/RTP guidelines (1.16 OR) versus 5-11 and 15-19-year-olds.[39] Academic difficulty, however, was seen more in those under the age of 11 (33%) compared to those 11 and older (28%).[35] This coincides with data that showed no difference between 13-16 and 17-19-year-olds in the number of new school problems following concussion.[36] Lastly, it was seen that when compared to students ages 5-7, older students (≥8)

are at increased odds of suffering a concussion while participating in youth football (≥2.10 OR).[40]

High School Student Data

Three articles specifically discussed high school students.[20,32,42] Wan et al. utilized interviews to identify the lack of clarity within RTL guidelines and inconsistency of RTL recommendations.[20] Conversely, Philipson et al. found that students who report concussion symptoms to schools received many student-centered accommodations.[32] Post et al. surveyed athletes from six states and recommended that healthcare professionals be aware of the reasons why athletes refrain from reporting sport-related concussion, such as wanting to continue playing or not considering the injury was serious.[42] No articles solely investigated elementary or middle school students.

Combined Elementary, Middle, and High School Stakeholder Data

Nine articles aggregated stakeholder data.[9,18,22,27,43–45] Multiple studies discussed a lack of guidance with implementation of RTL support,[18,33,44] with communication,[27,33,45] training and education[9,27,45] cited as barriers. The importance of a multidisciplinary RTL plan was uniformly noted, with 80% of school nurses believing they could function as part of a RTL team; though the lack of communication with the diagnosing provider was identified as a chief barrier to a nurses ability to support a student with concussion.[27]

High School Stakeholder Data

Seven articles specifically discussed high school stakeholders.[2,23,24,26,46–48] Management of concussions was discussed across multiple articles, highlighting athletic trainers[2,23,46] and school nurses[46,48]. Graff et al. indicated that online education modules were successful in improving teacher knowledge of concussion[47]; however, Janson et al. suggests that schools are likely underestimating concussion rates due to limited ability of school professionals to recognition signs and symptoms[24]. No articles solely investigated elementary or middle school stakeholders.

Critical Appraisal

The mean percentage of 'yes' answers for qualitative, quantitative, and mixed methods data were 75%, 74%, and 88%, respectively. A 'no' response was assigned most often to questions pertaining to the researcher's influence culturally and theoretically, any influence of the researcher, and any confounding. An 'unsure' response was not assigned. For further details of the critical appraisal scores, please refer to Table 5.

Table 5. Critical Appraisal

Author	*Q1*	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*	*Q9*	*Q10*	*Q11*
Qualitative Studies											
Baker et al. (2014)[16]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Bell et al. (2017)[49]	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A
Bomgardner et al. (2019)[50]	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N/A
Bradley-Klug et al. (2015)[19]	Y	Y	Y	Y	N	N	Y	Y	N	N	N/A
Dachtyl et al. (2017)[51]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Davies et al. (2018)[2]	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N/A
DeMatteo et al. (2015)[52]	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y
DeMatteo et al. (2020)[10]	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Fetta et al. (2021)[53]	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Gioia et al. (2014)[54]	Y	Y	Y	Y	Y	N	Y	N	N	N	N/A
Grady et al. (2017)[55]	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N/A
Halstead et al. (2013)[17]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Halstead et al. (2018)[56]	Y	Y	Y	Y	Y	N	N	N	N	Y	N/A
Howland et al. (2018)[46]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N/A
Howland et al. (2021)[28]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Hughes et al. (2018)[57]	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A
Iverson et al. (2016)[58]	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N/A
Master et al. (2012)[59]	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A
McAvoy et al. (2018)[60]	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N/A
McAvoy et al. (2020)[61]	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N/A
McNeal et al. (2017)[62]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Murata et al. (2019)[63]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A

Provance et al. (2016)[64]	Y	Y	Y	Y	Y	N	N	N	N	N	N/A
Purcell et al. (2019)[11]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Romm et al. (2018)[43]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Rose et al. (2015)[65]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Santiago et al. (2016)[66]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Sarmiento et al. (2019)[18]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Stokes et al. (2019)[67]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Sullivan et al. (2022)[44]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Susnara et al. (2019)[68]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Sutcliffe et al. (2018)[69]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Wan et al. (2021)[20]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Quantitative Studies											
Arbogast et al. (2017)[39]	Y	Y	Y	N	Y	Y	Y	Y	Y	N/A	N/A
Baker et al. (2015)[36]	Y	Y	Y	N	Y	Y	N	N	Y	Y	N/A
Chrisman et al. (2019)[40]	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y
DeMatteo et al. (2019)[37]	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
DeMatteo et al. (2021)[38]	Y	Y	Y	N	N	Y	Y	N	N	Y	Y
Dreer et al. (2017)[9]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Graff et al. (2016)[47]	Y	N	Y	Y	N	Y	Y	Y	Y	N	N/A
Grubenhoff et al. (2015)[30]	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
Janson et al. (2019)[24]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Kasamatsu et al. (2016)[23]	Y	Y	Y	N	N	N	Y	Y	N/A	N/A	N/A
Kemp et al. (2022)[25]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
O'Neill et al. (2017)[31]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Olympia et al. (2016)[48]	N	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Philipson et al. (2021)[32]	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
Post et al. (2021)[42]	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
Swanson et al. (2017)[35]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Takagi-Stewart et al. (2022)[29]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Thompson et al. (2016)[6]	Y	Y	Y	Y	N	N	N	N	N	Y	Y
Wing et al. (2015)[27]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Yengo-Kahn et al. (2021)[41]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N/A
Mixed Methods Studies											

Blackwell et al. (2017)[45]	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A
Conrick et al. (2020)[26]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
DeMatteo et al. (2015)[22]	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Howland et al. (2021)[70]	Y	N	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A
Lyons et al. (2017)[33]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N/A
Y: Yes. N: No. N/A: Not Applicable. N/A was also used when the critical appraisal tool did not include 11 questions.											

ConQual

Of the 13 synthesized findings, nine incorporated solely high quality illustrations: *Team roles should be defined, prepared, and trained; Identify a point person on the team; Communication outside the school is difficult; Communication is a critical component; Steps to facilitate communication; Lack of education across several RTL team members; Education/training needed both on concussion and RTL management; Symptoms are not visible, Teachers do not know until told; and Symptoms are not visible, academic accommodations are difficult*. Two synthesized findings consisted of solely low-quality illustrations: *Regularly monitor students' symptoms; Regularly monitor students' academic progress.* The remaining two synthesized findings incorporated a mix of quality: *A multidisciplinary concussion management team should be formed* (high=3, low=1); *Resources are available, but are they enough?* (moderate=1, low=2, very low=1). Please refer to Table 6 for full details on the credibility and dependability of synthesized findings.

Table 6. ConQual Critical Appraisal

Synthesized Finding	*Source*	*Dependability*	*Credibility*	*ConQual Score*	*Comments*
A multidisciplinary	Hughes 2018[57]	Hughes 2018* 2.Yes	Downgrade 2 levels (-2)**	Low	*4-5 'yes' responses: the finding remains

concussion management team should be formed	Baker 2014[16]	3.Yes 4.Yes 6.Yes 7.N/A Baker 2014* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Susnara 2019* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Bell 2017* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Gioia 2014* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Halstead 2013* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Bradley-Klug 2015* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Fetta 2021* 2.Yes 3.Yes 4.Yes 6.Yes 7.No	No change**	High	unchanged **Mix of unequivocal/ equivocal illustrations
	Susnara 2019[68]		No change**	High	
	Bell 2017[49]		No change**	High	
Team roles should be defined. Members prepared and trained	Gioia 2014[54]		No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
Identify a point person on the team	Halstead 2013[17]		No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Bradley-Klug 2015[19]		No change**	High	
	Fetta 2021[53]		No change**	High	
	Halstead 2013[17]		No change**	High	

Communication outside the school is difficult	Sarmiento 2019[18]	Sarmiento 2019* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Bradley-Klug 2015* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Hughes 2019* 2.Yes 3.Yes 4.Yes 6.Yes 7.N/A	No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Sarmiento 2019[18]		No change**	High	
	Sarmiento 2019[18]		No change**	High	
	Bradley-Klug 2015[19]		No change**	High	
	Bradley-Klug 2015[19]		No change**	High	
Communication is a critical component	Hughes 2018[57]		No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
Steps to facilitate communication	Sarmiento 2019[18]		No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal

	Hughes 2018[57]		No change**	High	illustrations
Lack of education across several RTL team members	Wan 2021[20]	Wan 2021* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Romm 2018* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Gioia 2014 2.Yes 3.Yes 4.Yes 6.No 7.Yes DeMatteo 2015* 2.Yes 3.Yes 4.Yes 6.Yes 7.No Sutcliffe 2018* 2.Yes 3.Yes 4.Yes 6.No 7.Yes	No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Romm 2018[43]		No change**	High	
	Romm 2018[43]		No change**	High	
Education/training needed both on concussion & RTL management	Gioia 2014[54]		No change**	High	**All unequivocal illustrations
	Gioia 2014[54]		No change**	High	
Resources are available, but are they enough?	Wan 2021[20]		Downgrade 1 level (-1)**	Moderate	*4-5 'yes' responses: the finding remains unchanged **Mix of unequivocal/equivocal illustrations
	DeMatteo 2015[22]		No change**	Low	
	DeMatteo 2015[22]		Downgrade 2 levels (-2)***	Low	

	Sutcliffe 2018[69]		Downgrade 1 level (-1)**	Very low	
Regularly monitor the student's symptoms	Bradley-Klug 2015[19]	Bradley-Klug 2015 2.Yes 3.Yes 4.Yes 6.No 7.Yes	Downgrade 2 levels (-2)**	Low	**All equivocal illustrations
Regularly monitor the student's academic progress	Bradley-Klug 2015[19]		Downgrade 2 levels (-2)**	Low	**All equivocal illustrations
Concussion symptoms are often not outwardly visible. Teachers do not know until told	Lyons 2017[33]	Lyons 2017* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Sarmiento 2019* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Wan 2021* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Santiago 2016* 2.Yes 3.Yes 4.Yes 6.No 7.Yes	No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Sarmiento 2019[18]		No change**	High	
	Wan 2021[20]		No change**	High	
	Santiago 2016[66]		No change**	High	

Because symptoms are not visible, academic accommodations are difficult for teachers	Howland 2018[46]		No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Halstead 2018[56]		No change**	High	

Discussion

This investigation aimed to review the current RTL literature for its principal components. Furthermore, our findings are intended to serve as an important reference for academic, legislative, and medical stakeholders creating or revising a RTL policy. Our review finds that both qualitative themes and quantitative narratives coincide, and collectively highlight the need for a well-defined RTL team and increased educational efforts for school personnel. These recommendations, however, overwhelmingly pertain to the high school settings as a scarcity of data was discovered for grades K-8 (elementary and middle schools). For perspective, 13,618 articles were assessed for eligibility, 0.004% were included (n=58), with 31% (n=18) of these 58 reporting some mixed form of data from a K-8 sample, and zero reporting solely on K-8 students or stakeholders. Two chief conclusions can be drawn here: future research must work diligently to fill the significant gap within K-8 RTL; the findings of this review and the discussion to follow must be assumed to have limited specificity to grades K-8 until otherwise disproven. Accordingly, we will discuss how our converged findings inform policy recommendations for high school RTL.

Converged Finding 1. Members and Point Person

Findings urge schools to establish a clear RTL team, consisting of family, medical, and school staff, as well as a designated point person to manage interdisciplinary communication. Student

support teams involving academic, medical, and family representatives are unanimously recommended (100%), but few designate an RTL point person (21-56%).[25] Researchers agree that a RTL team would benefit from physician, teacher, school administration, parent, school counselor/psychologist, and student inclusion[2,18,21,62]; therefore, we suggest RTL policies include these individuals, at minimum. Research[23,25] frequently identifies athletic trainers as the point person for managing a student-athlete (73.7%)[23], yet others[2,18,21,62] suggest the school nurse would be a better fit for this role. While there is not a definitive answer for who this individual should be, it is important that this professional be comfortable in their role. For instance, athletic trainers have the training to diagnose and manage concussions, suggesting their fit; however, high school nurses similarly report confidence with concussion management (95%)[24]. School nurses are also able to easily communicate with teachers, administrators, counselors/psychologists, parents, and students throughout the school day.[17,18,25,62] Teachers especially rely on school nurses to inform them when a student is injured and how to appropriately manage their concussion in the classroom.[18] Most school nurses believe that part of their job is to convey concussion information to students and staff prior to and after a concussion takes place.[18,25] They also have a broad understanding of the importance of talking to students about following a gradual return-to-sport and return-to-school protocol.[18,62] School nurses understand the frustration of students not wanting to “fall behind” in school or take rest breaks during the school day.[18] They even self-identify as “concussion advocates and educators” for school staff.[18,25,56] In terms of accessibility, the school nurse is present throughout the school day, and can periodically monitor the student's symptoms.[62] Overall, our appraisal strongly recommends the school nurse to fill the role of RTL point person. It is important to note, however, that the athletic trainer plays a vital role in the RTL management of student-athletes with concussion. Athletic trainers can serve as a liaison between the school physician, nurse, and athletic director.[56] Typically, athletic trainers are not on school grounds full-time,[18,25,56] and cannot monitor student-athletes throughout the day; yet they are first to respond to concussions

after the school day ends. Therefore, athletic trainers should work closely with school nurses, informing them of after-school injuries that will need support the following day.

Converged Finding 2. Overcoming Barriers to Communication

While athletic trainers report communicating often or always with high school athletic directors (72.1%) and school nurses (65.3%), equivalent consistency is not always displayed by other RTL team members.[23] Most often, a concussion is self-reported by the student (50%), followed by the parent (15%), medical provider (3%), and school staff (3%).[26] School nurses (73.8%) indicated a greater need for communication with the medical provider that diagnosed the concussion; thus, we propose schools request that all students (athlete or otherwise) and parents sign a medical release form at the beginning of each school year.[27] With written permission, school nurses will be permitted to communicate with the student's medical provider, should they require guidance. This achieves communication between medical and academic team members, yet rapid dissemination of information within the academic team also requires improvement. It is imperative that teachers remain informed to appropriately implement accommodations in their classroom, however, because students will be missing school, attending half-days, or taking frequent rest breaks throughout the day, teachers cannot expect timely information to be conveyed by the student. Therefore, we recommend the academic point person (i.e. nurse) utilize secure school district email to notify teachers of changes to the students' progress. Finally, communication between the academic and family team presents its own set of unique challenges. School professionals believe that communication with parents is difficult because they may be reluctant to accept that their child needs to take time away from usual activities to support recovery.[71] Consequently, school professionals do not receive a full or accurate account of the injury or its severity.[71] Implementation of the medical release form will allow the academic team to communicate with the medical provider, alleviating the need to receive full details from home. We understand that communication must still take place with the student's family, therefore we recommend making use of voice or video messaging (i.e. phone

call, video conferencing) rather than paper handouts or email. A physical document requires certainty that the student will deliver the paper to their guardian, whereas a phone call links the academic team directly to home. Additionally, communication through email, particularly those with sensitive health information, requires a secure method of delivery, which may be compromised if sent outside the school system. Thus, phone or video conferencing ensures that the academic team is transferring information to the student's parent or guardian quickly and safely.

Converged Finding 3. Increasing Concussion Knowledge and Training in the School System

There is a clear lack of concussion knowledge and training among educators, administrators, principals, and school counselors.[69] Teachers often express not understanding the severity of a concussion or the corresponding interventions,[31,69] and without any medical background or education, providing appropriate care is difficult.[43] Providing educators, administrators, principals, and counselors with educational tools about concussion management will allow them to provide the proper support in the classroom.[31,60,72] Educational tools or materials should be concise, actionable, and easy to read with suggestions on how to implement adjustments in the classroom.[18] They should also include common signs and symptoms of concussion, roles of RTL team members, and common adjustments to use in the classroom.[17,25,28] Authors suggest that these resources be provided online, through written materials (pamphlets), workshops, and presentations.[17,19,45,73] While online training is economical and equally effective as in-person training, learners are less satisfied with their experience.[74] Accordingly, we recommend schools make use of a blended learning technique when possible, to maximize the benefits of both face-to-face and online training. Evidence shows that blended learning can even be more effective than traditional learning methods in the healthcare profession,[75,76] suggesting that medical RTL team members would benefit from these trainings as well. Intentional efforts geared towards

providing concussion training to RTL team members will better prepare personnel with the knowledge and skills that have long been absent.[60]

Converged Finding 4. Recommendations in the Classroom

A chief component of any RTL protocol is a clear list of adjustments for teachers to utilize for students. Several authors[23,27,68,77] stress this recommendation, highlighting various supports including, taking breaks from class, facilitating longer time on tests, wearing a hat or sunglasses in school, using earplugs, 30-minute class sessions, and 15-minute break periods. Teachers should also be provided with a list of temporary adjustments that can be rapidly implemented.[26] These supports should be ready to use 48 hours post-injury, as students are no longer prescribed lengthy periods of cognitive rest.[10,78] In fact, consensus opinion urges students to return to school prior to symptom resolution, which necessitates RTL team members to be trained and prepared.[61] Once in school, a gradual return to full activity is suggested[61,62,77]; however, an estimated 30% of students will not complete a gradual protocol in the anticipated amount of time (i.e. < 1 month).[61] Students who experience a prolonged recovery will likely require more formal accommodations such as a 504 plan or IEP,[25,28,62,65,68,69] which school personnel should be ready to implement if needed.

Converged Finding 5. Tackling the Invisible Injury

Concussion is unlike other injuries in that their effects are often undetected by others. For this reason, concussions are frequently referred to as the 'invisible injury', and cause concern and frustration among teachers. Accordingly, teachers are encouraged to consult with the school nurse or athletic trainer to bolster their understanding of concussion, as recognition of common signs and symptoms of concussion could help teachers guide students suspected of head injury towards the RTL point person. Engaging in the educational opportunities discussed previously will also promote teacher independence, as teachers could refer back to the online training materials they were provided, permitting on-demand refreshment of knowledge.

Overall, a successful RTL effort should focus on ushering students towards proper school support. This is initially accomplished with identification of concussion in the student; however, because most concussion symptoms are not outwardly apparent, open channels of communication are perhaps an equivalent method for parents, students, athletic trainers, or alike to alert RTL team members to a student's concussion.

Strengths

The current systematic review has several notable qualities, namely the inclusion of six databases and 39 keywords, amassing nearly 33,000 articles. This volume exceeds previous systematic reviews,[11,79] and speaks to the comprehensive nature of our approach. Additionally, previous systematic reviews report on both quantitative and qualitative RTL data, yet the use of a formal mixed-methodology in their extraction or analysis of findings is not discussed. Lastly, our assessments for bias and quality of evidence were individualized to the type of article being assessed, ensuring applicability with our appraisal.

Limitations

This systematic review searched multiple databases through an extensive set of keywords, yet despite these efforts, our study still has various limitations. For instance, the included articles displayed clinical and methodological heterogeneity, therefore, a meta-analysis of the retrieved data was not possible, and a quantitative narrative approach was used in its place. Furthermore, because research has yet to adequately measure the effectiveness of RTL protocols; our recommendations remain summative, rather than comparative. Lastly, our review found no articles that presented data isolated to students in kindergarten, elementary, or middle school; therefore, this review may have limited specificity to these settings. We strongly recommend that future research target these students and identify the nuances that may accompany RTL for children.

Conclusion

To our knowledge, the current review represents the largest systematic review of K-12 RTL literature to date. The synthesized themes, narratives, and converged data highlight the need for a RTL team and increased educational efforts in the school system. RTL policies in the high school setting should establish a RTL team with a combination of family, medical, and school members, as well as designate the school nurse as point person to coordinate communication. Additionally, implementation of a medical release waiver, secure email, and phone or video calling will improve communication efforts with medical providers, the academic team, and family, respectively. High school professionals should also be provided with concise and actionable educational tools targeting recognition of concussion signs and symptoms, roles of RTL team members, and adjustments to implement in the classroom. Utilization of a blended learning educational program allows for increased independence and the ability to refer back to materials when needed. Lastly, while elementary and middle schools share a similar structure to high schools, we caution readers from using these recommendations as a set of blanket guidelines across all of K-12. Acknowledging this, our findings provide state and local legislators with a comprehensive reference in which to structure a secondary school RTL policy.

Registration

This research was registered with PROSPERO, CRD42022332106. The review protocol may be accessed at https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=332106.

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Conflicts of Interest

The Authors declare that there is no conflict of interest.

Availability of Data and Material

Data will be made available by ZB upon request.

Author Contributions

Primary authors MD and SG participated in all aspects of the study. ZB was responsible for inception of the study idea and adjudicating disagreements during the screening process. All authors were responsible for drafting and editing the manuscript.

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Legends to Figures and Tables

Figure 1. PRISMA Flowchart

Figure 2. QARI Data Extraction Instrument

Figure 3. MAStARI Data Extraction Instrument

Figure 4. Sample Critical Appraisal Tool

Figure 5A. Ranking for Dependability. This figure represents how a score for dependability is reached during the ConQual process and is based on the answers to five critical appraisal questions.

Figure 5B. Ranking for Credibility. This figure represents how a score for credibility is reached during the ConQual process and is based on the congruency of the author's interpretation of supporting data.

Figure 5C. ConQual Scoring Example

Figure 6. Meta-Aggregation of Data

Table 1. PECO Framework

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Table 6. ConQual Critical Appraisal

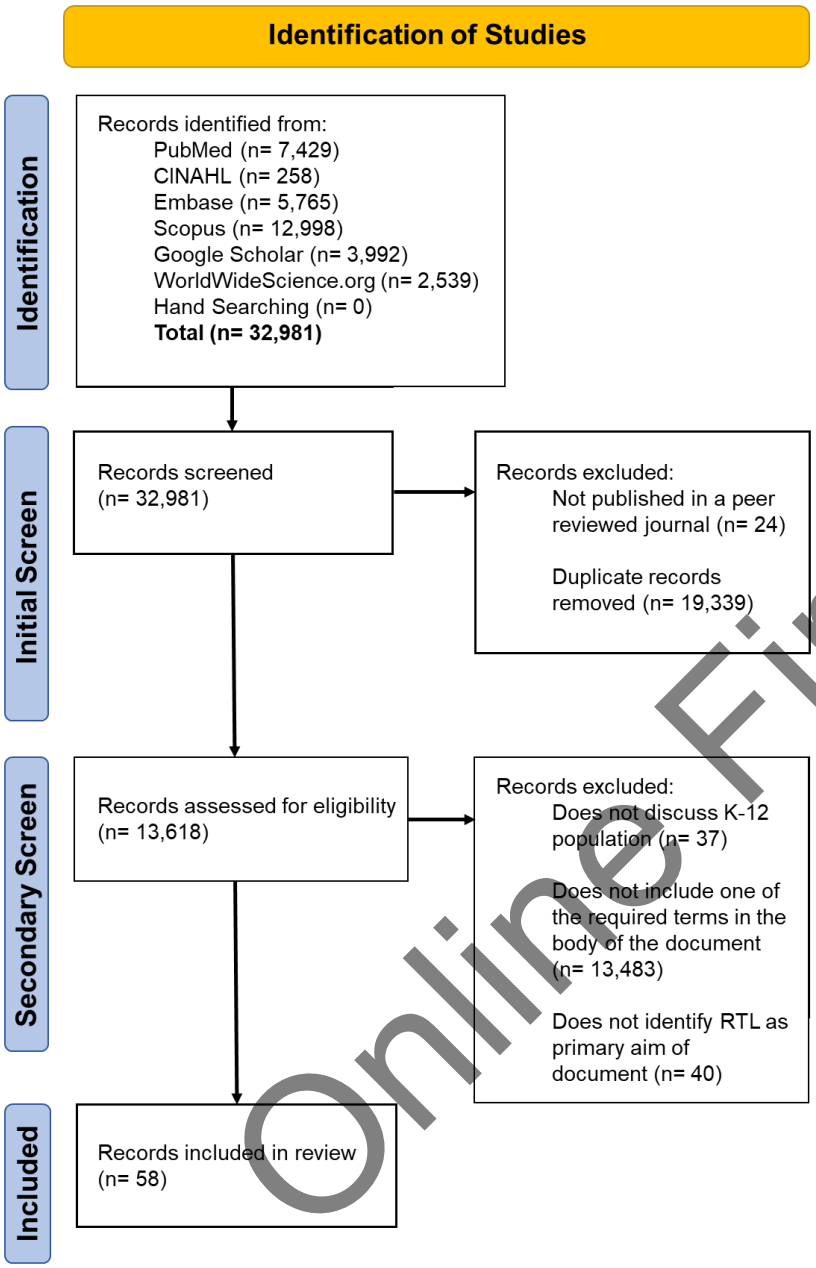


Figure 1. PRISMA Flowchart

JBI QARI Data Extraction Form for Interpretive & Critical Research

Reviewer _____ Date _____

Author _____ Year _____

Journal _____ Record Number _____

Study Description

Methodology

Method

Phenomena of interest

Setting

Geographical

Cultural

Participants

Data analysis

Authors Conclusions

Comments

Complete Yes ☐ No ☐

Findings	Illustration from Publication (page number)	Evidence		
		Unequivocal	Credible	Unsupported

Extraction of findings complete Yes ☐ No ☐

Figure 2. QARI Data Extraction Instrument

JBI Data Extraction Form for Experimental / Observational Studies

Reviewer _____ Date _____

Author _____ Year _____

Journal_____ Record Number_____

Study Method

RCT ☐ Quasi-RCT ☐ Longitudinal ☐

Retrospective ☐ Observational ☐ Other ☐

Participants

Setting _____

Population _____

Sample size

Group A _____ Group B _____

Interventions

Intervention A _____

Intervention B _____

Authors Conclusions:

Reviewers Conclusions:

Study results

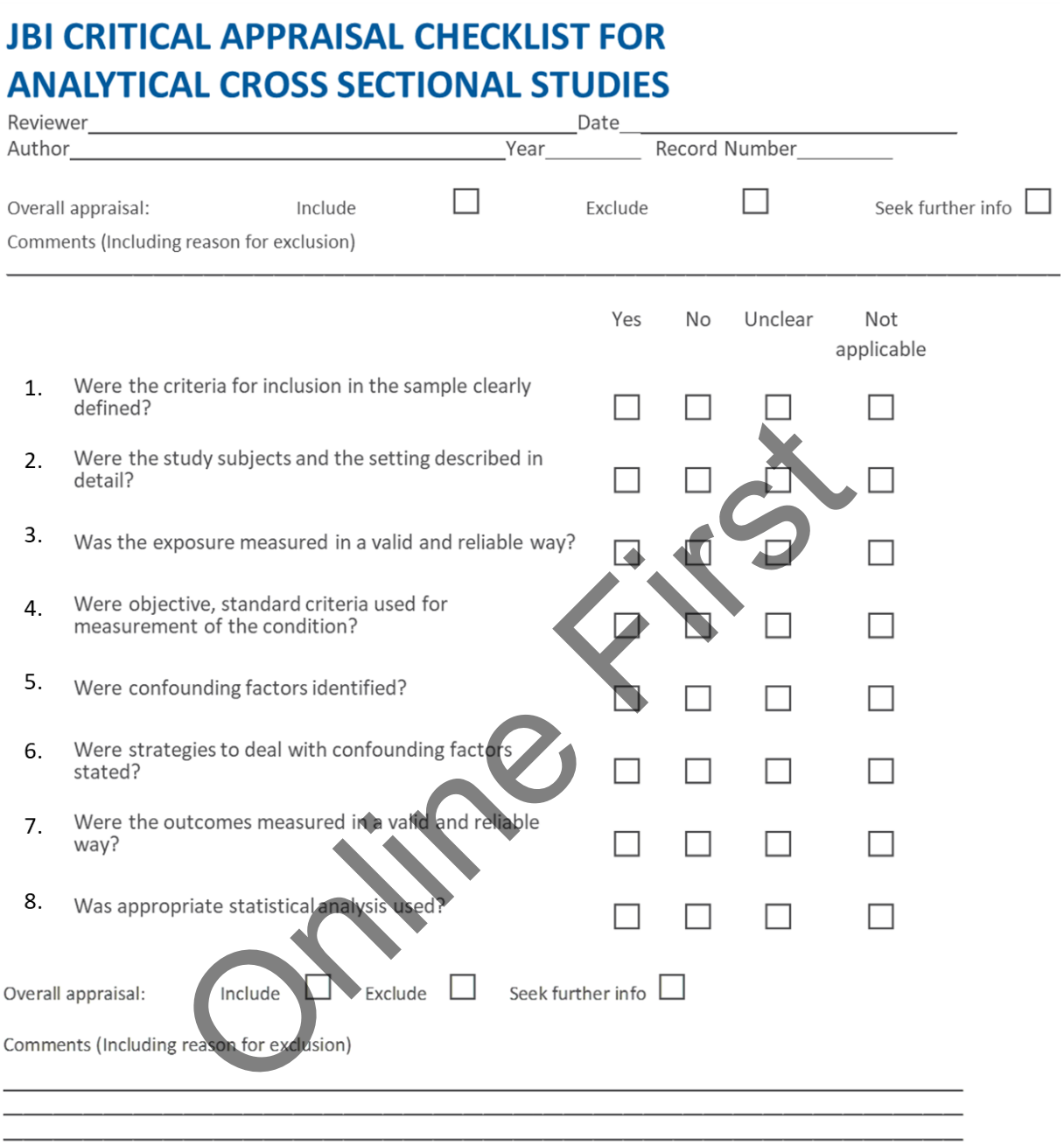
Dichotomous data

Outcome	Intervention ( ) number / total number	Intervention ( ) number / total number

Continuous data

Outcome	Intervention ( ) number / total number	Intervention ( ) number / total number

Figure 3. MAStARI Data Extraction Instrument



JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer_____ Date_____

Author_____ Year_____ Record Number_____

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

_____

		Yes	No	Unclear	Not applicable
1.	Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2.	Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3.	Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4.	Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5.	Were confounding factors identified?	☐	☐	☐	☐
6.	Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7.	Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8.	Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

_____

_____

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Figure 4. Sample Critical Appraisal Tool

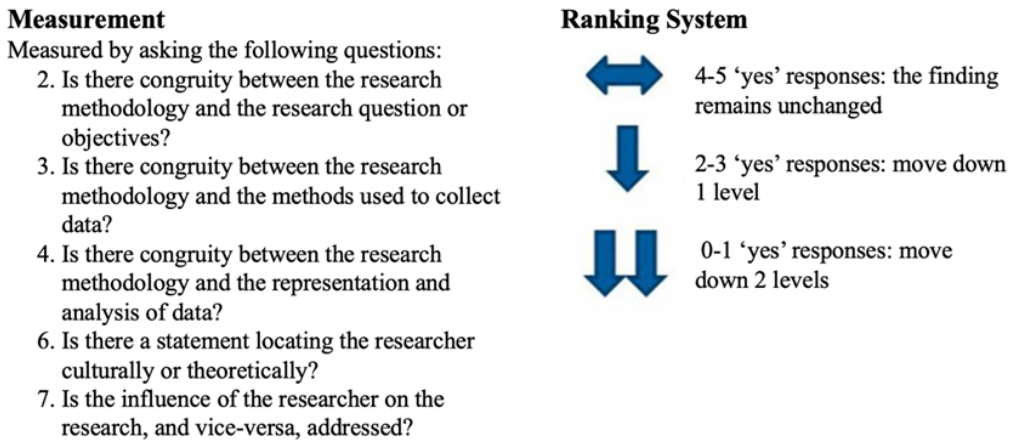

Figure 5A. Ranking for Dependability. This figure represents how a score for dependability is reached during the ConQual process and is based on the answers to five critical appraisal questions.

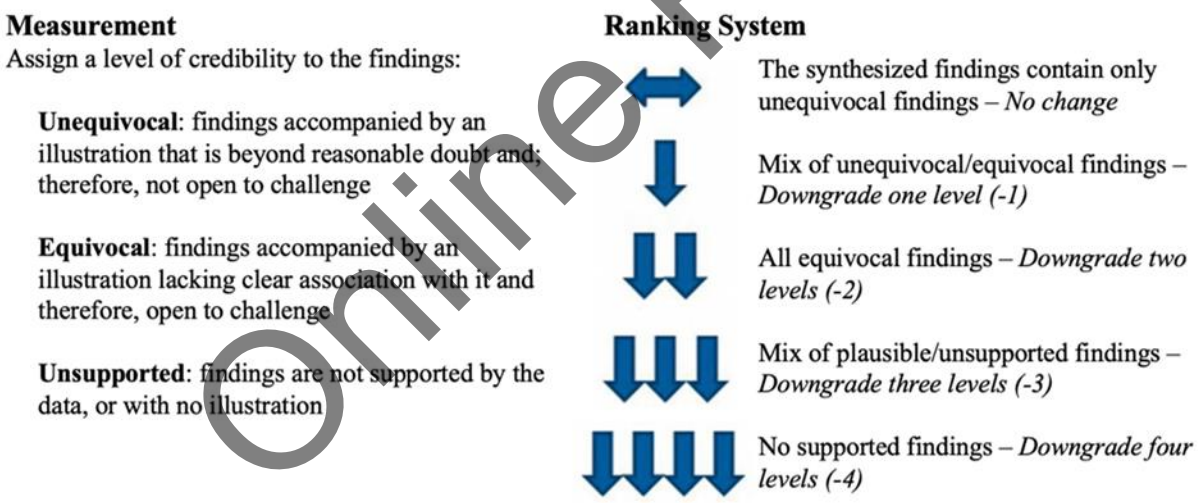

Figure 5B. Ranking for Credibility. This figure represents how a score for credibility is reached during the ConQual process and is based on the congruency of the author's interpretation of supporting data.

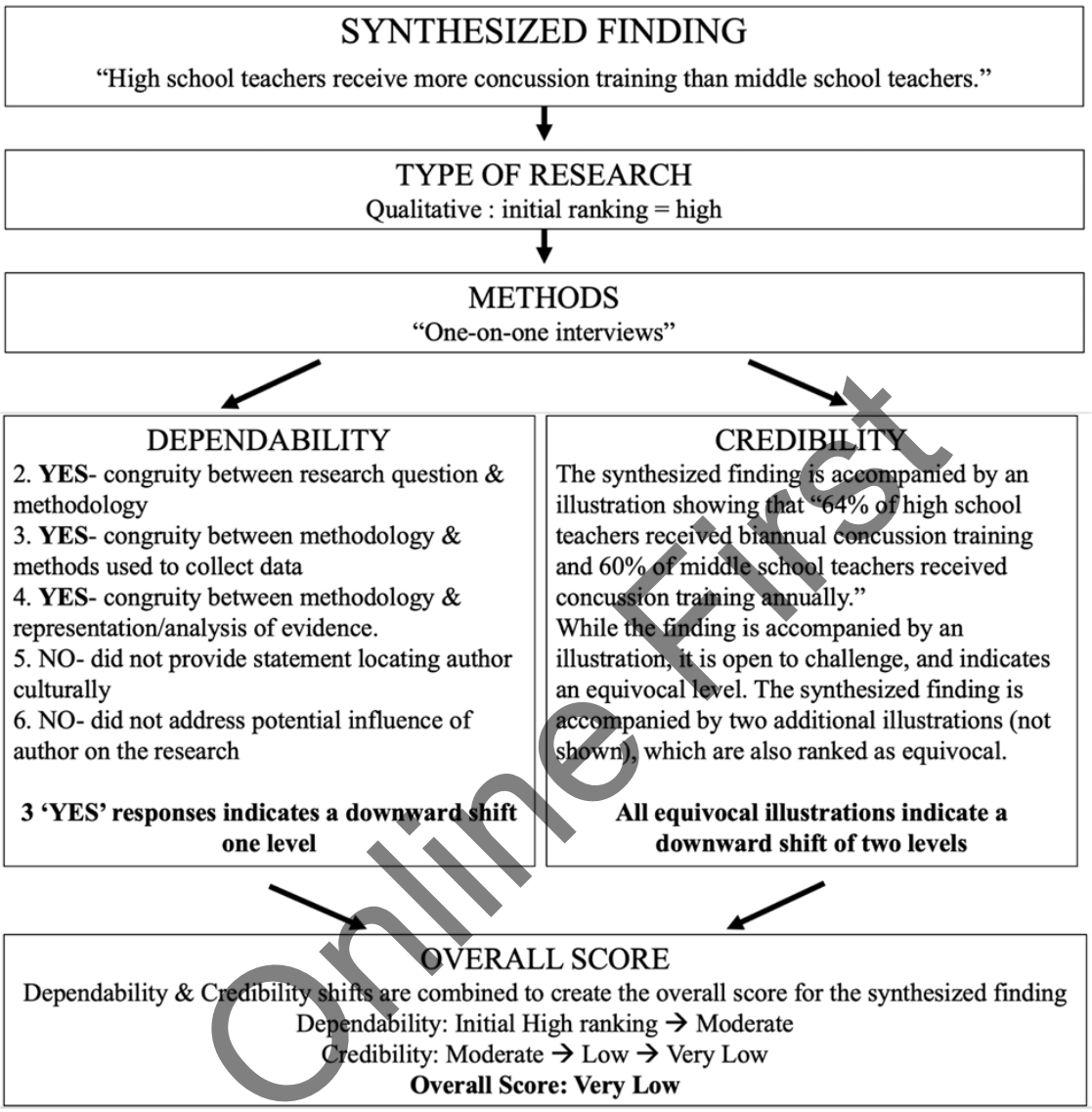

Figure 5C. ConQual Scoring Example

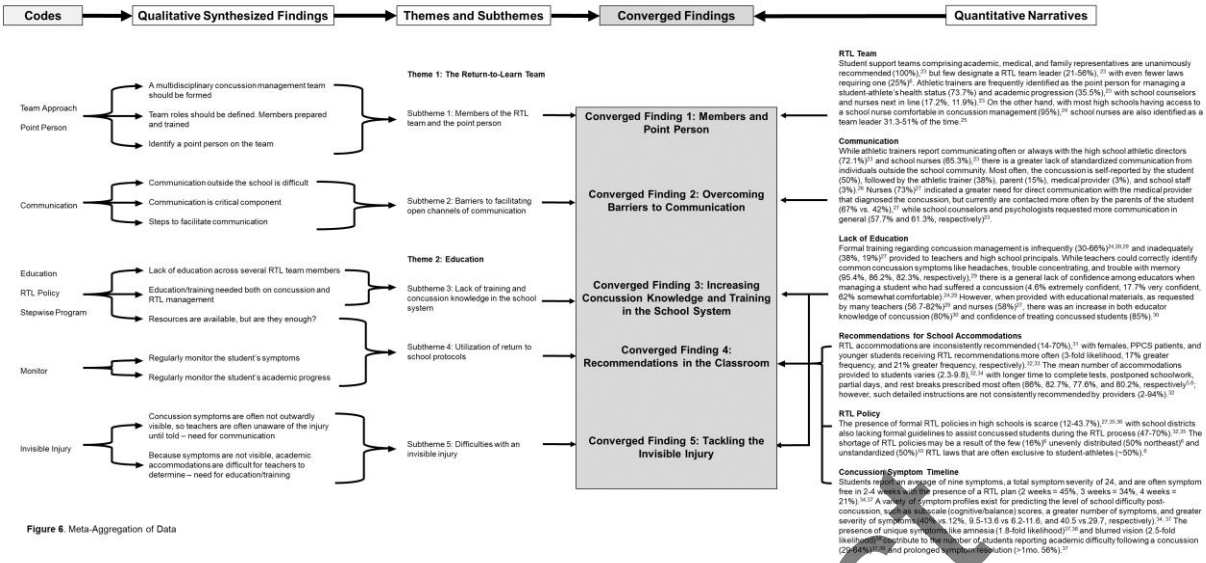

Figure 6. Meta-Aggregation of Data

Table 1. PECO Framework		
		Rationale
Population	K-12 education	These educational settings have implemented, revised, or are in the process of formulating RTL policies, which may or may not be required by state law.
Exposure	Concussion	Temporary disability of interest.
Comparison	Qualitative and quantitative data	Both data types must be appraised to formulate a comprehensive conclusion.
Outcome	The necessary components to a RTL policy	Findings will inform legislators, school administrators, and policy makers who are tasked with establishing RTL guidance.

Table 2. Keywords			
Population	*Exposure*	*Comparison*	*Outcome*
K-12	Concussion	RTL	Content
Primary	Mild traumatic brain injury	Laws	Scope
Secondary		Legislation	Standards
High school		Return to learn	Population
Middle school		Return to school	Comparison
Elementary school		Return to class	Systematic review
Adolescents		Return to classroom	Evidence-based
Children		Return to academics	
		Academic adjustments	
		Accommodation	
		504	
		Individuals with disabilities act	
		Individual education plan	
		Management	
		Department of education	
		Department of public health	
		Protocol	
		Policies	
		Guidelines	

Table 3. Preliminary Search Term Testing	
Database	Searches
PubMed (Medline)	Search mild traumatic brain injury, concussion procedures, ((concussion) AND (adolescents)), concussion management, ((concussion) AND (children)), ((concussion) AND (department of education)), ((concussion) AND (secondary schools), ((concussion) AND (middle school)), ((concussion) AND (primary school)), ((concussion) AND (return to sport)), ((concussion) AND (Adolescent)), ((concussion) AND (policy) AND (procedures)), ((concussion) AND (504 plans)), ((concussion) AND (individuals with disabilities act)), (concussion) AND (laws)), (concussion) AND (academic adjustment)), (concussion) AND (return to classroom)), (concussion) AND (return to class)), (concussion) AND (return to learn)), (concussion) AND (guidelines in K-12 setting)), ((concussion) AND (k-12)), ((concussion) AND (children)), ((concussion) AND (management in k-12)), ((concussion) AND (elementary schools), ((concussion) AND (middle school)), ((concussion) AND (primary schools))
CINAHL	Search mild traumatic brain injury, concussion procedures, concussion and adolescents, concussion management, concussion and children, concussion and department of education, concussion and secondary schools, concussion and middle school, concussion and primary school, concussion and return to sport, concussion and return to learn, concussion and return to classroom, concussion laws, concussion procedures, concussion and individuals with disability act, concussion and policies and procedures

Table 4. Summary of Findings					
Author	*Methodology & Methods*	*Participants & Setting*	*Phenomenon or Outcome of Interest*	*Intervention*	*Main Findings*
QUALITATIVE STUDIES					
Baker et al. (2014)[16]*	Commentary.	N/A.	Principles for RTL after concussion.		1. Resolution of symptoms is most often complete within 2 weeks, recovery can take longer, especially in children and adolescents. 2. There is growing attention to return to learn but no consensus yet or accepted guidelines. 3. We have proposed a set of principles, a graduated return to learn protocol, and a set of core academic accommodations that is informed by the broader concussion literature as well as the work of others

					who have written on this topic.
Bell et al. (2017)[49]*	Narrative review.	N/A.	Clinical implications of youth sports concussion laws.		1. Reach out to the local health department, school, or community organization to understand how your state's youth sports concussion law is being interpreted. 2. Monitor changes to state and local legislation and school policies that might impact clinical practice. 3. Utilize a comprehensive approach to concussion assessment. 4. Consider rehabilitative strategies and consultation with specialized health care professionals to manage student-athletes with protracted recovery.

					5. Coordinating closely with parties responsible for RTL and RTP while abiding by relevant ethical and legal responsibilities. 6. Identify best practices in RTL. 7. Preparation and education may be key to enable health care professionals to fulfill these duties.
Bomgardner et al. (2019)[50]*	Narrative review.	N/A.	Return to school challenges for the post-concussion student.		1. Teachers should be aware of the challenges post-concussion students face when returning to school. 2. Awareness of other basic concussion signs and symptoms of physical, emotional, and sleep complications can aid the teacher. 3. Schools should have a return to learn plan in place to implement and

					provide resources for teachers to help their students readjust to the school environment.
Bradley-Klug et al. (2015)[19]*	Literature review.	N/A.	Present a school-based protocol that includes a stepwise progression.		1. Implementation of a multitiered system of support, incorporating steps of the return-to-learn protocol, is recommended for student success. 2. A potential limitation to this type of protocol relates to the interdisciplinary collaboration necessary to support the student. 3. Communication of critical information between key stakeholders, including the student, caregivers, educators, and medical professionals, is critical. 4. School psychologists can

					serve as the facilitator of the school-based protocol and as the liaison between stakeholders.
Dachtyl et al. (2017)[51]*	Collaborative model case study.	165 pre-K to grade 12 students, Speech Language Pathologists and Athletic Trainers.	Describe an academic concussion management protocol designed for grades Pre-K to 12, called Cognitive Return to Exertion.		1. Concussion management process can provide necessary support for students and their families and is rewarding for school personnel. 2. Relationships among personnel can be developed and strengthened through working together toward the shared goal of student success after concussion. 3. CoRTEx and other similar protocols can be used as models for SLPs to create their own academic concussion management protocols.

Davies et al. (2018)[2]#	Qualitative semi-structured interviews.	64 athletic trainers from high schools.	Evaluate the strategies commonly used to implement concussion laws at the school & district levels, as reported by certified athletic trainers.		1. Common themes in implementation strategies emerged across jurisdictions. 2. Identification of strategic approaches to implementation will help ensure proper concussion management and education, reducing negative health outcomes among youths with concussions. 3. Implementation of concussion laws in schools relies on common tenets: removal from play, return to play, and concussion education.
DeMatteo et al. (2015)[52]*	Scoping review	10 articles and 3 web-based resources.	Identify & describe management strategies to ensure safe return to activity and return to school of children with traumatic brain injury and determine if they are evidence-based.		1. Determined that the most comprehensive guidelines for management are focused on adults. 2. Evidence concerning

					prolonged recovery patterns in children and the impact of concussion on the developing brain suggests that pediatric-specific guidelines are needed for RTA and RTS after MTBI/concussion.
DeMatteo et al. (2020)[10]*	Systematic review.	RTA/RTS protocols in children aged 5-18 years. 11 articles included.	Determine the effects of following RTA and RTS protocols on clinical outcomes for children with concussion.		1. The current data support the recommendation that children in the acute stage postconcussion should undergo 1-2 days physical and cognitive rest as they initiate graduated RTA/RTS protocols. 2. Prolonged rest may increase reported symptoms and time to recovery.
Fetta et al. (2021)[53]*	Systematic review.	28 articles included in the review.	Identify facilitators and barriers to the implementation of RTL		1. Need for enhanced communication

			protocols in academic settings for student athletes following concussive injury.		amongst stakeholders in the RTL process. 2. Identification of concussion symptoms and understanding the unseen impact of someone who has suffered an SRRC are paramount to ensuring an appropriate gradual RTL plan. 3. Existence of legislation can improve an institution's awareness of the impact of SRRC but specific education must be utilized to cement tenets of RTL protocols into daily practice. 4. It's vital that a clear line of communication among all stakeholders occurs to ensure a holistic approach to gradual

					RTL and protocol implementation.
Gioia et al. (2014)[54]*	Commentary.	N/A.	Medical school partnership in guiding return to school following mild traumatic brain injury in youth.		1. A systematic gradual return to school process is proposed, including levels of recommended activity and criteria for advancement. 2. A strong medical-school partnership will maximize outcomes for students with mTBI.
Grady et al. (2017)[55]*	Commentary.	N/A.	Develop a systematic approach to the initial concussion evaluation and customized school accommodations to aid in the school reentry process.		1. Primary care providers responsible for providing initial management of school reentry. 2. Early rest is associated with faster recovery, too much rest is detrimental and some degree of light aerobic activity should be allowed, even while symptomatic.

					3. A graduated RTS program is recommended. 4. Primary care provider can customize a wide variety of academic accommodations to successfully facilitate the school reentry process.
Halstead et al. (2013)[17]*	Clinical report.	N/A.	Provide a better understanding of possible factors that may contribute to difficulties in a school environment after a concussion.		1. Students with a concussion may need academic adjustments in school to help minimize a worsening of symptoms. 2. Adjustments may often be made in the individual classroom setting without formal written plans, such as a 504 plan or IEP. 3. Students with symptoms lasting longer than 3 to 4 weeks may benefit from a more detailed assessment

					by a concussion specialist. 4. A team approach consisting of the medical team, the school team, and the family team to assist the student in his or her return to learning is ideal. 5. Students should be performing at their academic “baseline” before returning to sports, full physical activity, or other extracurricular activities following a concussion. 6. Education of all individuals in-volved with students who sustain a concussion is necessary to provide adequate adjustments, accommodations, and long-term program modifications for the students.

					7. Additional research is necessary to strengthen and provide more evidence-based recommendations for appropriate adjustments for students following a concussion.
Halstead et al. (2018)[56]*	Book chapter.	N/A.	Monitor school-aged students and assist their reintegration into normal academics following their concussion.		1. Basic principles of making academic adjustments to minimize worsening of symptoms should be considered. 2. Improving communication between healthcare professionals and schools and continuing to implement procedures in schools to aid in students' recovery following concussion are necessary to improve the quality of care.

Howland et al. (2018)[46]#	Recorded focus groups interviews.	11 School nurses, 10 athletic trainers in high schools/public schools.	Assess implementation of legislated regulations relative to the management of students' head injuries during extracurricular sports in MA.		1. School nurses and Athletic trainers play an important role in the management of middle school and high school students' concussions when given the authority to do so through legislation and regulation.
Howland et al. (2021)[28]*	Viewpoint	N/A.		N/A.	1. RTL procedures can facilitate recovery for children and adolescents reintegrating into school post-concussion. 2. Although all states and the District of Columbia have youth sports concussion legislation, few of these laws address RTL. 3. All state youth concussion laws should address RTL, with provisions

					for post-concussion school reintegration for all students, not just student athletes.
Hughes et al. (2018)[57]*	Narrative review.	N/A.	Provide information on how to recognize students who may be experiencing post-concussion syndrome, as well as guidelines for a graduated RTL plan.		1. Using the team approach and return-to-learn plan, the student can potentially avoid long-term cognitive and motor deficits, plus possibly recover more quickly.
Iverson et al. (2016)[58]*	Commentary.	N/A.	Return to school following sport-related concussion.		1. Clinicians can provide practical and logical guidance for using academic accommodations to manage symptoms during the school day. 2. The return to school process is best facilitated by an established relationship between defined school personnel and the community

					health care provider, each with their own roles and responsibilities in the support of the student.
Master et al. (2012)[59]*	Systematic review.	N/A.	Address the importance of properly timed school re-entry.		1. Corresponding RTL protocol in an essential prerequisite for RTP and is an important component of recovery and return to normal activity. 2. Specific instructions in the form of a prescription for cognitive and physical rest followed by a gradual RTL plan are essential to help student athletes recover from concussion.
McAvoy et al. (2018)[60]*	Narrative review.	N/A.	Familiarize healthcare providers and parents with the educational language, laws, and processes as they relate to a		1. Allowing school districts to direct the application of existing ascending levels of educational

			comprehensive ascending level of academic support.		support for students with concussion as they RTS can promote robust and positive outcomes.
McAvoy et al. (2020)[61]*	Systematic review consensus statement.	16 national organizations.	Establish cross discipline consensus on some essential elements of RTL.		1. Demonstrated consensus on a number of essential elements, from a wide variety of professional disciplines who participate in the care of students following a concussion, as a starting place for some guidance on RTL.
McNeal et al. (2017)[62]*	Narrative review.	N/A.	Provide guidance on RTL. Discuss difficulty with the development of an individualized health care plan.		1. Students should be performing at their academic baseline before returning to sports, full activity or other extracurricular activities following a concussion. 2. Often a lack of communication between

					coaches/ATs/school faculty. 3. Collaborative team effort based on the symptoms and needs of the individual student. 4. A well-coordinated concussion management team that communicates effectively between its members is key. 5. No return to sport or activity should occur before the child/adolescent athlete has managed to return to school.
Murata et al. (2019)[63]*	Narrative review.	N/A.	Describe the rise in concussion for youth. Describe current prevention and treatment strategies used with youth populations; promote specific RTL strategies for concussed youth.		1. A youth's ability to transition back to school requires that specific adjustments are made by educators to allow for the youth to acclimate himself or herself to educational tasks

					without increasing symptoms. 2. Education and awareness of concussions for parents, friends, school personnel, and administrators are necessary for those individuals to assist with the immediate care of a concussion. 3. RTL should be a priority for youth as they return to daily activity.
Provance et al. (2016)[64]*	Narrative review.	N/A.	Review current evidence regarding concussion treatment and RTS and RTP recommendations to provide the primary care and sports medicine physician with practical guidelines for managing concussions.		1. Primary care physicians or sports medicine providers should be systematic in their approach to concussion management. 2. Concussion patients may require special accommodations at school or work, and a symptom guided

					approach is recommended. 3. Current research, state legislation and consensus guidelines may assist practitioners in providing more consistent and safer care for their injured patients.
Purcell et al. (2019)[11]*	Systematic review.	SRC in children aged 5-18 years 17 articles.	Evaluate the evidence regarding (1) factors affecting RTS and (2) strategies/accommodations for RTS following sport-related concussion in children and adolescents.		1. Schools should have a concussion policy and offer individualized academic accommodations to students recovering from SRC on RTS; a medical letter should be provided to facilitate provision/receipt of academic accommodations. 2. Students should have early, regular, medical follow up following SRC to help with RTS and monitor recovery.

					3. Students may require temporary absence from school after a SRC.
Romm et al. (2018)[43] †	Recorded semi-structured interviews.	16 teachers & 6 school administrators in 7 middle schools and 3 high schools within a large, ethnically and economically diverse public school system.	Examine schoolteachers' and administrators' perceptions of concussions, management, and implementation of RTL guidelines.		1. Teachers and school administrators recognize that concussions are a serious problem and differ in their understanding of concussion, management, and implementation of RTL guidelines. 2. Teachers and administrators are equally versed in concussion and implementing RTL guidelines. 3. Provide easily accessible RTL resources for teachers and concussion management team stakeholders.
Rose et al. (2015)[65]*	Narrative review.	N/A.	Examine the available data and expert		1. School accommodations

			recommendations that can support a student's successful RTS following concussion.		need to occur quickly, which makes it difficult to rely on traditional mechanisms for specialized education plans 2. Healthcare providers and school personnel must work together to develop a RTS plan for the student that is flexible and that implements tailored academic accommodations. 3. Guidelines for school-based concussion management largely derive from expert opinion with limited empirical support.
Santiago et al. (2016)[66]*	Commentary.	N/A.	Examine existing evidence on RTL guidelines, offer ideas of school accommodations that can be made for students who have experienced a concussion, review the situations in which it's		1. Majority of concussions resolve with rest and gradual return to physical and cognitive activity. 2. Activities, physical or

			recommended to seek guidance from a concussion specialist or sports medicine physician.		cognitive, that exacerbate concussion symptoms must be ceased temporarily. 3. Primary care pediatricians can help coordinate with the school administrative team to plan for a smooth recovery and gradual return.
Sarmiento et al. (2019)[18] †	Recorded focus groups.	19 professionals in schools serving grades 6-12 School professionals from each census region.	Assess school professionals' perceptions of concussion, information needs about concussion & experiences with concussion management in middle and high schools.		1. Participants strongly believe in the importance of concussion and improving RTL for students; however, challenges interfere with school professionals' ability to support students. 2. There is a lack of guidance to help implement and monitor a student's accommodations in a coordinated way. 3. There is a desire for resources, specifically from a

					student's healthcare provider..
Stokes et al. (2019)[67]*	Commentary.	N/A.	Provide information on the prevalence, recognition and management of concussions in the adolescent populations who participate in physical education.		1. Further guidance is needed for educators to be informed on the process of referring the student when a concussion is suspected, monitoring the student's progress in the classroom, and adapting educational activities based on the student's current needs. 2. Further education and training are also needed on a consistent and regular basis for all educators. 3. Establishing and using a chain of command in each school, specific to the school's resources and personnel, will help educators in

					navigating and managing their classrooms.
Sullivan et al. (2022)[44] †	Recorded semi-structured interviews.	11 parents or legal guardians of children aged 11-17 years recovering from concussion Emergency Dept. or concussion clinic affiliated with Nationwide Children's Hospital.	Explore parents' experiences with and perceptions of their child's recovery from concussion, particularly with regards to the RTS process.		1. Parents suggested that rest as well as parent-child communication throughout the recovery process may promote a smoother transition back to the school environment following concussion. 2. Academic accommodations, RTS policies, support from school, officials and teachers helped facilitate a successful reintegration into the academic environment post-concussion. 3. Need for evidence-based guidelines for cognitive rest post-concussion and best

					practice guidelines/strategies that foster the successful reintegration into the academic environment post-concussion.
Susnara et al. (2019)[68]*	Commentary.	N/A.	Explore the need for mandated gradual classroom reintegration for student-athletes with concussion symptoms.		1. Systematized protocols for active communication among medical, school, and family team members. 2. All state and local governments should establish and implement some form of RTL procedures within their concussion guidelines. 3. Governments have the opportunity to hold the K-12 schools within their jurisdiction accountable, ensuring the recovery of our youth before

					reintegration into the classroom.
Sutcliffe et al. (2018)[69]*	Narrative review.	N/A.	Examine policies for RTL and how RTL intersects with best practices and special education laws and regulations.		1. Many of our current practices for reintegration into the school environment are based on expert consensus versus an evidence-base. 2. Few schools have concussion-specific protocols for RTL, specifically for the brief period, most adolescents will experience concussion symptoms, and many in the school system themselves feel they lack the proper training to implement such protocols independently. 3. Providers can help their patients by paying attention to the changing laws.

Wan et al. (2021)[20]¶	Ethnographic semi-structured interviews.	10, English-speaking parent-adolescent dyads From a concussion clinic in Menlo Park, California.	Better understand the perceptions of parent-adolescent dyads as male and female adolescents returned to learn after sustaining a concussion.		1. Guidelines are inconsistent for parents and adolescent children who RTL post-concussion. 2. Recommendations lack consistency and implementation strategies that lack clarity. 3. Individualized education plans should be employed by either using the institution or a treatment facility.
QUANTITATIVE STUDIES					
Arbogast et al. (2017)[39] Θ	Pre-post intervention study.	7,284 patients aged 0-17 years with a concussion and PCPs.		In-person training sessions; concussion-specific clinical decision support tool for PCP's- "SmartSet".	1.The utilization of a medical electronic clinical decision support tool, along with in-person training can effectively change a provider. 2. Thus leading to early adaptation or existing and emerging guidelines

					for concussion management and consistent and systematic documentation of those practices.
Baker et al. (2015)[36] Θ	Follow-up phone interview following initial diagnosis	117 student athletes aged 13-19 years.		N/A.	1. The presence of problems reported in school was associated with severity of concussion as represented by recovery time and the overall number of symptoms at the first clinic visit. 2. Gender, age, and previous concussions were not associated with school problems. 3. Athletes with computerized test scores below the ninth percentile were more likely to report school problems.

Chrisman et al. (2019)[40] Θ	Prospective cohort.	863 youth American football athletes in the Seattle area.		N/A.	1. Concussion rates in this study were slightly higher than previously reported, with 5 of every 100 youth sustaining a football-related concussion each season. One-half of youth were still symptomatic 3 weeks after injury.
DeMatteo et al. (2019)[37] Θ	Prospective cohort.	139 children/youth aged 5-18 years with concussive injuries Emergency dept. At McMaster Children's Hospital in Hamilton.		RTA and RTS protocols.	1. Children/youth RTS faster than they RTP in spite of the self-reported school-related symptoms they experience while moving through protocols. 2. Youth can progress simultaneously through the RTS and RTA protocols during stages 1-3. 3. Considering the numbers of youth having school difficulties post-concussion, full

					contact sport, stage 6, should be delayed until full and successful reintegration back to school has been achieved.
DeMatteo (et al. 2021)[38] Θ	Prospective cohort.	139 children/youth aged 5-18 years diagnosed with concussion & symptomatic upon enrollment.		N/A.	1. There is a significant negative association between PCSS score and RTS/RTA stage. 2. Half (53% and 56%) of participants adhered to RTS and RTA protocols.
Dreer et al. (2017)[9] †	Cross-sectional survey.	130 teachers/ instructors in Alabama.		N/A.	1. Teachers were able to recognize the more commonly experienced concussion symptoms as well as management strategies. 2. Given the daily influence of teachers on student tasks involving cognitive exertion, incorporation of formal concussion

					education for teachers is warranted.
Graff et al. (2016)[47]#	Pre-post online survey.	247 high school educators in Jefferson County Public Schools System Louisville, Kentucky.		20 minute online literature-based education module.	1. Online teaching module was successful at improving educators' knowledge and understanding of the American Academy of Pediatrics' "Returning to learning" recommendations. 2. Teachers have a solid baseline knowledge of concussions and focus should be on classroom interventions.
Grubenhoff et al. (2015)[30] Θ	Prospective longitudinal cohort.	179 participants aged 8-18 years at a level-1 pediatric trauma center emergency department.		30 day follow-up call.	1. Outpatient follow-up is not routine for concussed children; despite missing more school days, children with PPCS do not receive academic

					accommodations more often. 2. Outpatient follow-up may facilitate academic accommodations.
Janson et al. (2019)[24]#	Cross-sectional survey.	157 Indiana high school principals.		N/A.	1. The underestimation of concussion frequency highlights an opportunity for further education of high school principals to ensure all concussed students receive appropriate RTL accommodations.
Kasamatsu et al. (2016)[23]#	Cross-sectional survey.	1124 athletic trainers employed at secondary schools.		N/A.	1. ATs followed best practices for cognitive rest and RTL after concussion. 2. School professionals may be better suited to monitor recovery and facilitate academic support for symptomatic student athletes.

Kemp et al. (2022)[25]*	Scoping review.	56 empirical studies 44 expert articles.		N/A.	1. Describes the current landscape of RTL and provides guidance toward expanding the empirical literature to systematically determine best practices to serve students with concussions. 2. Literature supports the importance of trained interdisciplinary RTL teams, graded management approaches, outcome measures reflecting concussion effects and academic outcomes, and accommodations allowing modified RTS.
O'Neill et al. (2017)[31]*	Literature review.	35 articles included in the review of literature.		N/A.	1. More rigorous research is needed to inform concussion policy and practice to

					assist with pediatric concussion management. 2. Timing and intensity of RTL decisions should be considered carefully and multidisciplinary systems of care need to be educated and better prepared to manage these issues- especially parents, physicians, teachers, school admin, and the concussed youth.
Olympia et al. (2016)[48]#	Cross-sectional questionnaire.	1033 high school nurses and members of the National Association of School Nurses.		Questionnaire-developed by the authors and based on recommendations for cognitive rest, electronically distributed 3 times during the 2012-2013 academic year.	1. Detected a wide variability in compliance of schools and school nurses with national recommendations for cognitive rest.
Philipson et al. (2021)[32]¶	Prospective cohort.	115 students across 13		RTL care plan.	1. The use of a RTL care plan can facilitate the RTL of

		Seattle public high schools.			students with a concussion and may aid in the identification of students who are in need of longer-term support 2. Students who reported concussion symptoms to schools received many student-centered temp accommodations 3. Use of RTL care plan may identify students who will require longer term support and support RTL of students with concussion.
Post et al. (2021)[42]¶	Online questionnaire.	2,998 student athletes in 11 private and 2 public schools in Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island.		N/A.	1. ATs and healthcare professionals should be aware of the factors that may influence secondary student athletes' SRC reporting behavior, and associated RTL, and RTP timelines

					so they can better target concussion education and overall management for student-athletes. 2. Majority of athletes reported returning to school and sport within 13 days. 3. ATs and other healthcare professionals involved in the care of high school student athletes should be aware of potential differences between public and private school athletes in SRC history.
Swanson et al. (2017)[35] Θ	Cross-sectional cohort.	276 children were included from the childerns of Alabama concussion database.		Academic difficulty reported in children with prolonged post- concussive symptoms.	1.Vision problems were commonly reported in children with concussion and were associated with academic difficulty. 2. Comprehensive vision assessments should be

					considered in children reporting academic difficulty and in the development or return-to-learn protocols.
Takagi-Stewart et al. (2022)[29] Θ	Randomized comparative effectiveness trial.	200 adolescents aged 11-18 years with PPCS following a sports injury; parent-child dyads Subspecialty clinics in western Washington.		N/A.	1. Physician recommended academic accommodations within 90 days following concussion reflected adolescent needs. 2. Potential gap between physician recommendations and school implementation (GPA, concussion symptoms, depression, anxiety, HRQOL not associated w/ recommendations. 3. Need appropriate partnerships between physicians, students, and school systems to

					achieve student centered RTL.
Thompson et al. (2016)[6]*	Literature review.	8 RTL state concussion laws in the United States.		N/A.	1. Scarce and vague legal guidance regarding RTL. 2. Need for legislative action on the issue of RTL. 3. Improved integration of laws and research so that laws reflect best-practice guidelines.
Wing et al. (2015)[27] †	Cross-sectional survey.	151 New England K-12 school nurses (public and private schools) at the annual New England School Nurse Association School.		N/A.	1. Inform interdisciplinary medical teams about the importance of educating and facilitating effective “RTL” academic plans. 2. 1 in 5 school nurses in our survey did not feel comfortable with this role. 3. Concussion experts and programs should

					partner with primary care physicians and school physicians to develop uniform recommendations and forms to aid school nurses directing students' return to the classroom. 4. Physicians should provide every child w a concussion with written RTL and RTP protocols to be discussed w the school academic team. 5. Comprehensive team approach to concussion management should facilitate better outcomes.
Yengo-Kahn et al. (2021)[41] ⊙	Observational pre-post.	935 patients (375 pre-intervention and 560 in the post-intervention) diagnosed with a concussion		Effectiveness of simple intervention in improving discharge following a pediatric concussion.	1. Simple interventions such as peer-to-peer education and consensus guidelines-based instruction templates can

		and discharged from the pediatric emergency department.			significantly improve discharge readiness after pediatric concussion.
MIXED METHODS STUDIES					
Blackwell et al. (2017)[45] †	Mixed methods, cross-sectional.	142 school nurses at primary, middle, and high schools.	Characterize current RTL practices in Massachusetts area schools and determine if management practices differ in primary and secondary school populations.	N/A	1. Should be additional emphasis placed on RTL. 2. Shows some uniformity in the administration of academic support and accommodation following concussion, but suggests that such the current approach may not adequately support students at different stages of development and those who sustained non-sport-related injuries.
Conrick et al. (2020)[26]#	Mixed methods, questionnaire.	22 public high schools, grades 9-12 in the Washington network.	Use a community-engaged research framework to develop and evaluate the implementation of a student-centered care plan	N/A	1. Implementation of a student-centered, individually tailored care plan for RTL is feasible and

			that assists school personnel in facilitating RTL.		acceptable in public high schools. Future research should examine how to expediently initiate student-centered concussion care plans after diagnosis to optimize recovery.
DeMatteo et al. (2015)[22] *	Mixed methods, scoping review.	39 participants: physicians, schools, parents and children, public health departments, pediatric wards, concussion clinics, physician offices, family health teams	Develop evidence-informed materials to educate and advise/update physicians and other professionals about pediatric concussion.	.N/A	1. A balance of cognitive rest and timely return to school need to be considered for returning any student to school after a concussion. 2. Implementation of the new recommendations may be an important tool in prevention of prolonged absence from school and academic failure while supporting brain recovery
Howland et al. (2021)[70] †	Mixed methods,	219 school nurses at	Massachusetts Department of Public Health developed	N/A	1. 92% found the booklet extremely

	survey instrument for cross-sectional evaluation.	public and nonpublic elementary, middle, and high schools in Massachusetts.	RTL guidelines which were disseminated to school nurses at all public and nonpublic middle and high schools in the state. MDPH engaged the Injury Prevention Center at Boston Medical Center to survey Massachusetts SNs to assess the usefulness of the guidelines.		useful or moderately useful. 2. A concise document, such as the booklet, that can be understood by nonmedical stakeholders, can be a valuable tool for SNs in building consensus and collaboration when managing students' postconcussion school reintegration.
Lyons et al. (2017)[33] †	Mixed methods, survey & statewide summit.	83 educators, 57 school nurses, 14 administrators, and 30 parents, representing 144 schools in Washington State.	Develop a consensus-based RTL implementation model and process.	N/A	1. Washington state children have unmet needs upon returning to public schools after concussion. 2. Student-centered RTL model and checklist for implementing RTL guidelines can help schools provide timely RTL services following concussion. 3. All surveyed stakeholder groups

					requested more training, school RTL guidelines, increased communication between team members and availability of best practices to support RTL transitions post concussion.
Article reports on: * RTL generally, # stakeholders from the high school setting, † stakeholders from a combination of settings, ¶ high school grade levels, Θ a combination of grade levels.					

Table 5. Critical Appraisal											
Author	*Q1*	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*	*Q9*	*Q10*	*Q11*
Qualitative Studies											
Baker et al. (2014)[16]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Bell et al. (2017)[49]	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A
Bomgardner et al. (2019)[50]	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N/A
Bradley-Klug et al. (2015)[19]	Y	Y	Y	Y	N	N	Y	Y	N	N	N/A
Dachtyl et al. (2017)[51]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Davies et al. (2018)[2]	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N/A
DeMatteo et al. (2015)[52]	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y
DeMatteo et al. (2020)[10]	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Fetta et al. (2021)[53]	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Gioia et al. (2014)[54]	Y	Y	Y	Y	Y	N	Y	N	N	N	N/A
Grady et al. (2017)[55]	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N/A
Halstead et al. (2013)[17]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Halstead et al. (2018)[56]	Y	Y	Y	Y	Y	N	N	N	N	Y	N/A
Howland et al. (2018)[46]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N/A
Howland et al. (2021)[28]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Hughes et al. (2018)[57]	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A
Iverson et al. (2016)[58]	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N/A
Master et al. (2012)[59]	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A
McAvoy et al. (2018)[60]	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N/A
McAvoy et al. (2020)[61]	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N/A

McNeal et al. (2017)[62]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Murata et al. (2019)[63]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Provance et al. (2016)[64]	Y	Y	Y	Y	Y	N	N	N	N	N	N/A
Purcell et al. (2019)[11]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Romm et al. (2018)[43]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Rose et al. (2015)[65]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Santiago et al. (2016)[66]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Sarmiento et al. (2019)[18]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Stokes et al. (2019)[67]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Sullivan et al. (2022)[44]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Susnara et al. (2019)[68]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Sutcliffe et al. (2018)[69]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Wan et al. (2021)[20]	Y	Y	Y	Y	Y	N	Y	N	N	Y	N/A
Quantitative Studies											
Arbogast et al. (2017)[39]	Y	Y	Y	N	Y	Y	Y	Y	Y	N/A	N/A
Baker et al. (2015)[36]	Y	Y	Y	N	Y	Y	N	N	Y	Y	N/A
Chrisman et al. (2019)[40]	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y
DeMatteo et al. (2019)[37]	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
DeMatteo et al. (2021)[38]	Y	Y	Y	N	N	Y	Y	N	N	Y	Y
Dreer et al. (2017)[9]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Graff et al. (2016)[47]	Y	N	Y	Y	N	Y	Y	Y	Y	N	N/A
Grubenhoff et al. (2015)[30]	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
Janson et al. (2019)[24]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A

Kasamatsu et al. (2016)[23]	Y	Y	Y	N	N	N	Y	Y	N/A	N/A	N/A
Kemp et al. (2022)[25]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
O'Neill et al. (2017)[31]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Olympia et al. (2016)[48]	N	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Philipson et al. (2021)[32]	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
Post et al. (2021)[42]	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
Swanson et al. (2017)[35]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Takagi-Stewart et al. (2022)[29]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Thompson et al. (2016)[6]	Y	Y	Y	Y	N	N	N	N	N	Y	Y
Wing et al. (2015)[27]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
Yengo-Kahn et al. (2021)[41]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N/A
Mixed Methods Studies											
Blackwell et al. (2017)[45]	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A
Conrick et al. (2020)[26]	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	N/A
DeMatteo et al. (2015)[22]	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Howland et al. (2021)[70]	Y	N	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A
Lyons et al. (2017)[33]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N/A
Y: Yes. N: No. N/A: Not Applicable. N/A was also used when the critical appraisal tool did not include 11 questions.											

Table 6. ConQual Critical Appraisal

Synthesized Finding	*Source*	*Dependability*	*Credibility*	*ConQual Score*	*Comments*
A multidisciplinary concussion management team should be formed	Hughes 2018[57]	Hughes 2018* 2.Yes 3.Yes 4.Yes 6.Yes 7.N/A Baker 2014* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Susnara 2019* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Bell 2017* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Gioia 2014*	Downgrade 2 levels (-2)**	Low	*4-5 'yes' responses: the finding remains unchanged **Mix of unequivocal/ equivocal illustrations
	Baker 2014[16]		No change**	High	
	Susnara 2019[68]		No change**	High	
	Bell 2017[49]		No change**	High	
Team roles should be defined. Members prepared and trained	Gioia 2014[54]		No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
Identify a point person on the team	Halstead 2013[17]		No change**	High	*4-5 'yes' responses: the finding remains unchanged

		2.Yes 3.Yes 4.Yes 6.No 7.Yes Halstead 2013* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Bradley-Klug 2015* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Fetta 2021* 2.Yes 3.Yes 4.Yes 6.Yes 7.No			**All unequivocal illustrations
	Bradley-Klug 2015[19]		No change**	High	
	Fetta 2021[53]		No change**	High	
	Halstead 2013[17]		No change**	High	
Communication outside the school is difficult	Sarmiento 2019[18]	Sarmiento 2019* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Bradley-Klug 2015*	No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Sarmiento 2019[18]		No change**	High	

	Sarmiento 2019[18]	2.Yes 3.Yes 4.Yes 6.No 7.Yes Hughes 2019* 2.Yes 3.Yes 4.Yes 6.Yes 7.N/A	No change**	High	
	Bradley-Klug 2015[19]		No change**	High	
	Bradley-Klug 2015[19]		No change**	High	
Communication is a critical component	Hughes 2018[57]		No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
Steps to facilitate communication	Sarmiento 2019[18]		No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Hughes 2018[57]		No change**	High	
Lack of education across several RTL team members	Wan 2021[20]	Wan 2021* 2.Yes 3.Yes 4.Yes 6.No 7.Yes	No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Romm 2018[43]		No change**	High	

	Romm 2018[43]	Romm 2018* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Gioia 2014 2.Yes 3.Yes 4.Yes 6.No 7.Yes DeMatteo 2015* 2.Yes 3.Yes 4.Yes 6.Yes 7.No Sutcliffe 2018* 2.Yes 3.Yes 4.Yes 6.No 7.Yes	No change**	High	
Education/training needed both on concussion & RTL management	Gioia 2014[54]		No change**	High	**All unequivocal illustrations
	Gioia 2014[54]		No change**	High	
Resources are available, but are they enough?	Wan 2021[20]		Downgrade 1 level (-1)**	Moderate	*4-5 'yes' responses: the finding remains unchanged **Mix of unequivocal/equivocal illustrations
	DeMatteo 2015[22]		No change**	Low	
	DeMatteo 2015[22]		Downgrade 2 levels (-2)***	Low	
	Sutcliffe 2018[69]		Downgrade 1 level (-1)**	Very low	
Regularly monitor the student's symptoms	Bradley-Klug 2015[19]	Bradley-Klug 2015 2.Yes 3.Yes 4.Yes 6.No 7.Yes	Downgrade 2 levels (-2)**	Low	**All equivocal illustrations
Regularly monitor the student's academic progress	Bradley-Klug 2015[19]		Downgrade 2 levels (-2)**	Low	**All equivocal illustrations

Concussion symptoms are often not outwardly visible. Teachers do not know until told	Lyons 2017[33]	Lyons 2017* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Sarmiento 2019* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Wan 2021* 2.Yes 3.Yes 4.Yes 6.No 7.Yes Santiago 2016* 2.Yes 3.Yes 4.Yes 6.No 7.Yes	No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Sarmiento 2019[18]		No change**	High	
	Wan 2021[20]		No change**	High	
	Santiago 2016[66]		No change**	High	
Because symptoms are not visible, academic accommodations are difficult for teachers	Howland 2018[46]		No change**	High	*4-5 'yes' responses: the finding remains unchanged **All unequivocal illustrations
	Halstead 2018[56]		No change**	High	