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Beyond the Biomedical Model: A Modified Delphi Study for Developing and Validating a Holistic Minimum Data Set for a Student Electronic Personal Health Record

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Abstract

Background

Personal hygiene is a fundamental component of health and plays a critical role in disease prevention. Given students' exposure to communal environments and the immaturity of their immune systems, attention to students' personal hygiene is essential. The use of electronic records in this domain is highly effective and efficient. This study aimed to determine the data requirements and technical infrastructure for an app-/web-based electronic personal health record for students.

Methods

In this descriptive-developmental study, relevant documents were reviewed and consultations with experts were conducted to draft initial data elements and technical requirements for the student electronic personal health record. A checklist of data elements and technical features was created and rated using a three-point Likert scale. Content and technical validity were then assessed by an expert panel, and the Content Validity Ratio (CVR) was calculated using Lawshe's method. Items with CVR ≥ 0.75 were retained.

Results

Of 175 data elements and 23 technical components, experts ultimately approved 144 data elements across the following domains: student demographic information (12 items), parental information (16 items), physical and physiological data (25 items), mental health (10 items), spiritual health (5 items), physical activity (5 items), nutritional health (10 items), sleep health (13 items), social health (8 items), personal hygiene (10 items), injuries and incidents (6 items), and school-related information (19 items). Additionally, 22 technical infrastructure components for the student electronic personal health record were approved.

Conclusion

The identified data requirements and technical infrastructures provide an evidence-based foundation for designing and standardizing student electronic health records. Nevertheless, future field studies are required.

Introduction

Personal hygiene represents a cornerstone of public health, playing an essential role in preventing communicable and non-communicable diseases while enhancing overall quality of life [1]. Health-related behaviors—including personal cleanliness, balanced nutrition, regular physical activity, and appropriate

sleep patterns—constitute key dimensions of personal hygiene and are directly associated with physical and mental health outcomes [2]. Robust evidence demonstrates that simple hygiene interventions, such as handwashing with soap, can reduce gastrointestinal disease incidence by approximately 25–47% and significantly decrease the risk of respiratory infections [3, 4]. School-based hygiene interventions have further demonstrated reductions in infection-related absenteeism (RR 0.74, 95%CI 0.66 to 0.83) and improvements in hygiene knowledge and practices [5]. Conversely, inadequate adherence to personal hygiene practices across various settings is consistently associated with adverse health outcomes across all age groups [6].

Students represent a particularly vulnerable population due to their prolonged exposure to collective environments and the developmental immaturity of their immune systems, rendering them more susceptible to acquiring and transmitting infectious diseases compared to other demographic groups [7]. Insufficient personal hygiene practices among students may precipitate negative consequences, including increased school absenteeism, diminished classroom concentration, and poorer academic performance [5, 8]. Given that children and adolescents spend a substantial proportion of their daily time in educational settings, schools are recognized not merely as formal educational environments but as critical venues for health promotion and disease prevention [9]. Comprehensive water, sanitation, and hygiene (WASH) programs in schools have demonstrated the most significant and sustained impact, reducing diarrheal prevalence by up to 56% and increasing enrollment [10]. The availability of school-based health infrastructures and services—including structured health education programs, health status monitoring, and facilitation of hygienic behaviors—plays a pivotal role in institutionalizing health-promoting behaviors among students [9].

The rapid expansion of digital health technologies has catalyzed increasing attention toward mobile health (mHealth) tools and electronic health record (EHR) systems, particularly application-based and web-based platforms, as scalable, cost-effective, and accessible approaches for continuous education, monitoring, and management of health-related behaviors [11, 12]. Within the school health domain, application- and web-based electronic personal health records for students enable systematic and longitudinal documentation of health data, real-time access to health information, temporal analysis of students' health status, and enhanced interaction among students, families, and schools [13]. Self-management systems equipped with features such as intelligent reminders, real-time feedback, delivery of specialized content, and personalized interventions have been associated with increased user engagement and improved adherence to health-promoting behaviors [14]. Digital health interventions delivered in school settings have demonstrated effectiveness in improving physical activity, dietary intake, and multiple lifestyle behaviors [15, 16]. Nevertheless, the effectiveness and reliability of such systems are highly contingent upon the presence of standardized frameworks, clearly defined data requirements, and appropriately designed technical features for electronic health records [17]. These requirements contribute to improved data collection, storage, structuring, and exchange; ensure information interoperability; enhance system efficiency and effectiveness; and potentially reduce risks related to non-standardized design and data heterogeneity [18].

Numerous studies have examined self-management applications and mHealth interventions targeting student health; however, most have focused on one or a limited number of isolated personal hygiene components, such as nutrition or physical activity [19]. These studies often emphasize short-term behavioral outcomes or changes in specific health indicators rather than adopting a comprehensive, system-based approach [13]. This limitation is noteworthy, as personal hygiene is inherently multidimensional, encompassing physical, psychological, social, and behavioral domains that dynamically and reciprocally influence one another, thereby necessitating integrated and holistic health data analysis [20]. Although some research has proposed conceptual frameworks for electronic student health records, these efforts have largely remained at preliminary stages or have been restricted to theoretical or data-design studies, with a clear lack of systematically reported real-world and online implementation within school environments [21]. Prior research on minimum data sets for student electronic health records in Iran identified 271 approved data elements and emphasized the importance of including mental health details and modifying existing student health certificates [18]. Furthermore, many mHealth and adolescent health studies have insufficiently addressed standardized content frameworks, clearly defined minimum data sets, and interoperable data exchange models, leading to data heterogeneity and limited comparability and validity of health information—factors that pose significant barriers to the effective implementation of electronic health records in school health contexts [12, 22].

Given the critical importance of personal hygiene as a cornerstone of student health promotion, disease prevention, academic performance enhancement, and quality of life improvement, the implementation of self-management electronic personal hygiene record systems within school settings appears to be highly beneficial. However, the effectiveness of such systems is directly contingent upon the quality of informational content, the coherence of data elements, and the robustness of their technical features. The absence of a standardized and structured framework for defining essential data elements may lead to data inconsistency, limited monitoring and evaluation capacity, and reduced interoperability and comparability across systems. Therefore, the present study aims to determine the data requirements and technical infrastructure of an application- and web-based electronic personal hygiene health record for students, with the objective of providing an appropriate foundation for the effective management of students' personal hygiene by families and schools.

Methods

Study Design and Setting

This descriptive-developmental study was conducted to determine the data requirements and technical infrastructure for an application- and web-based electronic personal health record for students. The study was approved by the institutional review board and ethics committee of the School of Medical Sciences of Esfarayen (IR.ESFARAYENUMS.REC.1404.015). The research was carried out in two sequential phases: (1) identification and extraction of candidate data elements and technical components from existing documents and expert consultations, and (2) validation of the draft data set

through a formal content validity assessment by a panel of experts. This two-phase approach aligns with established methodologies for developing minimum data sets (MDS) in health information systems [23, 18].

Phase 1: Data Collection and Initial Draft Development

In the first phase, a comprehensive document review was conducted to identify relevant data elements and technical requirements. The sources examined included student personal hygiene records maintained by the Health Deputy of the University of Medical Sciences, individual health records currently used in schools, and official guidelines from the Ministry of Education. Additionally, a targeted literature review was performed to identify data elements previously proposed in studies of electronic health records for student and school health populations [18, 24].

To complement the document review and incorporate practical insights, an expert consultation meeting was convened. This session included public-health specialists, school principals, and members of the research team. The feedback from this meeting was systematically integrated into the draft checklist. This iterative process of document review followed by expert consultation is consistent with recommended approaches for developing consensus-based data standards in health informatics [25, 26].

Following these steps, an initial checklist was prepared comprising **175 data elements** across 12 health domains and **23 technical infrastructure components**. The checklist was formatted as a structured survey instrument, with each item accompanied by a three-point Likert-type response scale: "Essential" (score 3), "Useful but not essential" (score 2), and "Not essential" (score 1). This format enabled a quantitative assessment of expert consensus regarding the necessity of each proposed item.

Phase 2: Expert Validation and Content Validity Assessment

Expert Panel Composition

The content validation process was conducted by two separate panels of experts, reflecting the dual focus of the study on content and technical dimensions.

Content Panel: Eight experts were recruited via purposive sampling based on their professional expertise and research experience in student health. The panel comprised four faculty members in Health Education, two school health officers, and two psychologists. All panelists had a minimum of four years of professional and research experience in student health and school health records. The mean age of the panelists was 49 years (range: 41–58), and their mean professional experience in the field of student health was 10.7 years. Purposive sampling was employed given the specialized nature of the study and the limited pool of qualified experts in this domain, a strategy consistent with previous health informatics validation studies [18, 24, 27].

Technical Panel

Eight experts were recruited to evaluate the technical infrastructure components. This panel comprised four health information management specialists and four medical informatics specialists, all of whom had prior research or professional experience in electronic health record systems. The mean professional experience of this group was 6.3 years.

Validation Procedure

The draft checklist was presented to each expert in individual face-to-face sessions. In these sessions, experts were asked to assess the necessity of each item for inclusion in the student electronic personal health record by selecting one of the three Likert options. This method of individual assessment was chosen to minimise group influence and ensure independent expert judgments.

Experts were also invited to propose additional items that they considered important but which were not included in the initial draft. These suggestions were recorded in a designated "Recommendations" section at the end of the checklist. Proposed additions were subsequently reviewed by the full expert panel and, where consensus was reached, included in the final checklist through an additional validation round. This mechanism ensured that the final data set reflected a comprehensive and expert-driven selection of items.

Content Validity Ratio (CVR) Calculation

For quantitative assessment of content validity, the Content Validity Ratio (CVR) was calculated using Lawshe's method [28]. This approach measures the extent to which panelists consider an item "essential" for the intended purpose. Using the responses from the eight panelists in each group, the CVR for each item was computed using the following formula:

CVR = (n□ − N/2) / (N/2)

where:

- **N** = total number of expert panelists
- **n□** = number of panelists who rated the item as "Essential"

The CVR ranges from − 1 to + 1. A value of zero indicates that exactly half the panel considered the item essential; negative values suggest that the item may be non-essential. Values closer to + 1 indicate stronger consensus on the necessity of the item. The minimum acceptable CVR is determined by the number of experts, and for a panel size of N = 8, the critical threshold based on Lawshe's table is **CVR ≥ 0.75** [28]. This threshold was applied to both content and technical items. Items falling below this threshold were excluded from the final checklist. This method has been widely applied in health

informatics research for developing minimum data sets and content-validated instruments [18, 27, 29, 30].

Statistical analyses, including CVR calculations, were performed using SPSS version 26 (IBM Corp., Armonk, NY, USA).

Ethical Considerations

The study protocol was approved by the Ethics Committee of the School of Medical Sciences of Esfarayen (IR.ESFARAYENUMS.REC.1404.015). All experts provided informed consent prior to participation. The confidentiality of expert responses was maintained throughout the study, and data were anonymised during analysis.

Results

Following a comprehensive review of documents related to school health and existing student health records, and after conducting expert consultation meetings, an initial draft consisting of 175 data elements and 23 technical components was developed and organized into a structured checklist for validation by experts (Appendix 1).

The content validation expert panel comprised eight experts, including four health education specialists, two school health officers, and two psychologists. The experts had a mean age of 49 years, and their mean professional experience in the field of student health was 10.7 years. Validation of the technical infrastructure was conducted by four health information management specialists and four medical informatics specialists, all of whom had prior research experience in the field of electronic health records; the mean professional experience of this group was reported as 6.3 years. Each item was evaluated using a three-point Likert scale. Given that N = 8, the critical CVR threshold was set at CVR ≥ 0.75, based on Lawshe's table.

Following the validation process, a total of 31 items were excluded (Fig. 1 and Appendix 2). Ultimately, 144 data elements across 12 information domains—including student demographic information, parental information, physical and physiological health, mental health, spiritual health, physical activity, nutritional health, sleep health, social health, personal hygiene, injuries and accidents, and school-related information—along with 22 technical features and capabilities related to the infrastructure of the electronic personal health record for students were approved (Table 1). Among these, the Content Validity Ratio for 116 data elements and all 22 technical infrastructure components was equal to 1 (Fig. 2).

Table 1
Approved Data Elements and Technical Infrastructure Components

Data element	CVR	Data element	CVR
1-Student demographic information			
First and last name	1	Emergency contact number	1
Date of birth	1	Nationality	0.75
Gender	1	Number of family members	0.75
National code	1	The eldest child in the family	0.75
Educational background	1	Student supervisor (Father/Mother/Grandparent/Welfare/Other)	0.75
Location	1	Student status (healthy/disabled/incapable)	0.75
2- Information about the student's parents			
Information about the student's father		**Information about the student's mother**	
First and last name	1	First and last name	0.75
Age	0.75	Age	1
Contact Number	1	Contact Number	0.75
Occupation	1	Occupation	0.75
Education level	0.75	Education level	1
Living situation (life with/apart from the student)	1	Living situation (life with/apart from the student)	1
Family history of a specific disease	1	Family history of a specific disease	1
Life status (alive/deceased)	1	Life status (alive/deceased)	1
3-Physiological and physical information			
Weight	1	Vision status (healthy/unhealthy - record existing disorder)	1
Height	1	Speech status (healthy/unhealthy - recording existing disorder)	1
Body mass index	1	Hearing status (healthy/unhealthy - record existing disorder)	1
Blood type	0.75	Respiratory system health status (healthy/unhealthy - recording existing disorder)	1

Data element	CVR	Data element	CVR
1-Student demographic information			
History of chronic diseases (no/yes - name of disease)	1	Cardiovascular system health status (healthy/unhealthy - record existing disorder)	1
History of taking specific medications (no/yes - type of medication)	1	Health status of the skeletal system (healthy/unhealthy - recording existing disorder)	1
History of infectious diseases (no/yes - name of disease)	1	Skin system health status (healthy/unhealthy - record existing disorder)	1
History of non-communicable diseases (no/yes - name of disease)	1	Health status of the genitourinary system (healthy/unhealthy - recording of existing disorders)	1
History of allergies (no/yes - type of allergy)	1	Digestive system health status (healthy/unhealthy - record existing disorder)	1
Hospitalization/surgery history (no/yes - type of surgery)	0.75	Gland health status (healthy/unhealthy - record existing disorder)	1
Vaccination status (complete/incomplete - name of vaccines received)	1	Disability (healthy/unhealthy - registration of existing disorder)	1
Recent physical symptoms (name of symptoms)	1	General practitioner's opinion	1
Oral health status (healthy/unhealthy - record existing disorder)	1		
4- Mental health information			
History of psychiatric medication use (yes/no - name of medication)	1	Unusual embarrassment	1
Anxiety symptoms (no/yes - type of symptom)	1	Fear disorders	1
Symptoms of depression (no/yes - type of symptom)	1	Self-harming thoughts (no/yes - type of thoughts)	1
Concentration problems (no/yes - type of problems)	1	Other mental disorders (no/yes - type of disorders)	1
Obsessive-compulsive disorders	1	Psychologist's opinion	0.75
5- Spiritual health information			
Sense of meaning in life (high-medium-low)	1	Adherence to ethical values (high-medium-low)	1

Data element	CVR	Data element	CVR
1-Student demographic information			
Feeling of hope for the future (high-medium-low)	1	Spiritual resilience (high-medium-low)	0.75
Feeling of inner peace (high-medium-low)	1	Sense of belonging (high-medium-low)	0.75
Feeling of personal worth (high-medium-low)	1		
6- Physical activity information			
Duration of daily physical activity (in hours)	1	Daily sitting time	0.75
Duration of exercise per week	1	Student's favorite sport	1
Time spent working on a computer/mobile phone per day	1		
7- Nutritional information			
Breakfast consumption (eats/does not eat)	1	Daily dairy consumption	1
Type of nutrition in the first two years of life (breast milk/formula/other)	0.75	History of strict dietary diets	0.75
Number of meals	1	Daily fluid intake	0.75
Daily fruit and vegetable consumption	1	Amount of sugary drinks consumed per week	1
Amount of red meat consumed per week	1	Amount of processed food consumed per week	1
Amount of white meat consumed per week	1	Eating disorders (yes/no - type of disorder)	1
Amount of cereal consumed per week	1		
8- Sleep health information			
Bedtime	1	Teeth grinding in sleep (no/yes- frequency per week)	1
Wake-up time	1	Sleep talking (no/yes - frequency per week)	1
Nighttime sleep duration	1	Screaming and terrorizing in sleep (no/yes - frequency per week)	1

Data element	CVR	Data element	CVR
1-Student demographic information			
Sleep quality (good-average-poor)	1	Waking up (no/yes - frequency per week)	1
Daily nap duration	0.75	Nightmares (does not see/sees- number per week)	1
Using a mobile phone before bed (no/yes - type of use)	1	Other sleep disorders (no/yes - type of disorder)	1
Sleepwalking (no/yes - frequency per week)	1		
9-Social health information			
Peer relationships (good-average-poor)	1	Self-esteem level (high-medium-low)	1
Relationships with elders (good-average-poor)	0.75	Social adaptation (high-medium-low)	1
Communication skills (high-medium-low)	1	Participation in group activities (high-medium-low)	1
Level of self-confidence (high-medium-low)	1	Level of social support from others (high-medium-low)	0.75
10-Personal health information			
How often you use your toothbrush during the day	1	Nail cleaning	1
How often do you wash your hands during the day?	1	Number of deciduous and permanent teeth	1
Number of times you shower per week	1	Number of decayed teeth	1
Menstrual hygiene	1	Cleaning personal belongings	1
Hair care	1	Environmental hygiene	1
11- Accidents and injuries			
Falling or slipping from low-lying surfaces (no/yes - location of the accident - consequence of the accident - month of the accident - reason for the accident)	0.75	Vehicle accidents (No/Yes - Location of the accident - Pedestrian/rider - Consequence of the accident - Month of the accident - Type of vehicle)	0.75
Hit with a hammer (No/Yes - Location of the accident - Consequence of the accident -	1	Burns (No/Yes - Location of the accident - Type of caustic substance - Consequence of the accident - Month of the accident - Reason for the accident)	0.75

Data element	CVR	Data element	CVR
1-Student demographic information			
Month of the accident - Reason for the accident)			
Falling from a height (No/Yes - Location of the accident - Consequence of the accident - Month of the accident - Reason for the accident)	1	Wounds and injuries (No/Yes - Location of the accident - Causing object - Consequence of the accident - Month of the accident - Reason for the accident)	1
12- School information			
School name	1	Food items available at the school cafeteria	0.75
School type (public-board of trustees-non-profit-other)	1	Providing mental health and counseling services (type of service)	1
Grade (preschool/primary school/junior high school/ high school)	1	Conducting screening examinations at school (type of examination - period of performance)	1
Girls/boys/coed school	1	Average time spent on cultural, artistic and sports activities at school	1
Presence of a health care provider and health liaison at the school	1	The existence of student organizations and associations	1
Carrying out school health programs (types of programs)	1	Health education activities in school (not available/available - type of activities)	1
Class density (ratio of number of students in each class to the area of the class)	1	Total number of students	0.75
The condition of the toilets at the school	1	Access to soap and water	1
Classroom air conditioning (adequate/fairly adequate/inadequate)	1	Number of school shifts (single shift/double shift/other)	0.75
Outbreak of communicable diseases in school (duration of outbreak - type of disease - average percentage of infected people)	1		
13- Technical infrastructure			
Intelligent reporting and data analysis	1	Interactive training	1
Receiving, recording and storing data	1	Convenient user interface	1

Data element	CVR	Data element	CVR
1-Student demographic information			
Ability to create user profiles	1	Offline support	1
Data structuring	1	Expandability	1
Data exchange capability	1	Modular architecture	1
Data integrity	1	Stable performance	1
Multi-level user management	1	Information security and confidentiality	1
Smart reminders and alerts in voice and text	1	Access level control	1
Presenting analysis results graphically	1	Data encryption	1
Content personalization	1	Compliance with ethical principles and informed consent	1
Data/log change tracking	1	Can be used as an application and on the web	1

Student Demographic Information Domain

In the domain of student demographic information, 75 percent of the checklist data elements including given name and family name, date of birth, sex, national identification number, school grade, place of residence, and emergency contact number were approved with CVR = 1. The data elements nationality, household size, birth order, primary caregiver, and student status were approved with CVR = 0.75. Four items—basic insurance, supplementary insurance, class number, and years of academic delay—were removed from this domain.

Parental Information Domain

In the domain of parental information, five elements from the initial draft data set were removed and the remaining elements achieved the required scores for inclusion; these comprised given name and family name, age, contact number, occupation, educational level, living status, family medical history, and parental vital status for both mothers and fathers. Removed items included national code for both parents, physical and mental health status for fathers, and self-sacrifice status.

Physical and Physiological Information Domain

The largest number of data elements was approved in the domain of physical and physiological information, representing 83.3 percent of the initial draft items. The data elements in this domain included weight, height, body mass index, blood group, history of chronic diseases, history of use of specific medications, history of infectious and non-communicable diseases, history of allergy, history of hospitalization and surgery, vaccination status, recent physical symptoms, oral and dental health status,

vision status, speech status, hearing status, and the health status of the respiratory system, cardiovascular system, musculoskeletal system, integumentary (skin) system, genitourinary system, gastrointestinal system, endocrine glands, as well as disability and the general practitioner's opinion. The CVR of most of these items was equal to 1, and the experts reached consensus on the necessity of recording them in the students' electronic personal health record. Removed items included waist circumference, normal blood pressure, normal body temperature, history of illness in the past month, and history of hospitalization or medical treatment.

Mental Health Domain

In the mental health domain, two data elements were removed and ten data elements were approved by the experts with CVR equal to or above the threshold; these included history of psychotropic medication use, anxiety symptoms, depressive symptoms, attention problems, obsessive–compulsive disorders, atypical shyness, phobic disorders, self-harm ideation, other psychiatric disorders, and the psychologist's evaluation. Removed items were problem-solving ability and feeling lonely.

Spiritual Health Domain

In the present study, according to the experts' opinion, students' spiritual health was considered an independent and influential domain in the student health electronic record. Five data elements in this domain—sense of meaning in life, hope for the future, inner calmness, perceived personal worth, and adherence to ethical values—received unanimous agreement from all experts, and the data elements spiritual resilience and sense of belonging were approved by the majority of experts. Removed items included sense of purpose and types of spiritual activities.

Social Health Domain

In the domain of social health, 72.2 percent of the proposed items were approved, including relationships with peers and adults, communication skills, levels of self-confidence and self-esteem, social adjustment, participation in group activities, and the level of social support received from others. Removed items included history of bullying, trust in peers, and using social networks.

Physical Activity Domain

Data elements related to daily physical activity level, weekly duration of exercise, time spent using computers and digital devices, total daily sitting time, and the student's favorite sport were considered and approved in the physical activity domain. Removed items included intensity of physical activity, previous sports injuries, and family support for physical activity.

Nutritional Health Domain

In the nutritional domain, breakfast consumption, type of feeding during the first two years of life, number of meals, and consumption of fruits and vegetables, red meat, white meat, cereals, dairy products, fluids, sugar-sweetened beverages, and processed foods were among the approved data elements; additionally, a history of restrictive diets and eating disorders was added to the checklist by

the experts and received consensus from the majority of panelists. Removed items included undereating or overeating, family feeding pattern, and taking dietary supplements.

Sleep Health Domain

According to the experts, two items in the sleep health domain were removed, and the items bedtime, wake time, nocturnal sleep duration, sleep quality, duration of daytime napping, mobile phone use before sleep, sleepwalking, teeth grinding during sleep, sleep talking, screaming and night terrors, sleep inertia (difficulty awakening), nightmares, and other sleep disorders were declared necessary for inclusion in the student electronic personal health record. Removed items were regularity in bedtime and insomnia or hypersomnia.

Personal Hygiene Domain

All items in the personal hygiene domain were approved by the experts with the highest CVR values. The items in this domain comprised frequency of toothbrushing per day, number of handwashing episodes per day, frequency of bathing per week, menstrual hygiene, hair hygiene, nail hygiene, numbers of primary, permanent, and decayed teeth, hygiene of personal belongings, and environmental hygiene.

Injuries and Incidents Domain

In the injuries and incidents domain, six items were approved, including vehicle accidents, falls from low-lying surfaces, burns, wounds and injuries, being hit with a hammer, and falls from height, each with associated sub-elements regarding location, consequences, timing, and causes. One item—need for rehabilitation follow-up—was removed from this domain.

School-Related Information Domain

Among the essential data elements in the school-related domain were school name, type, educational level, gender composition, the physical environment and school facilities affecting student health, prevalence of diseases in the school, student health services provided, periodic screening programs, classroom density, access to soap and water, toilet conditions, and outbreak information. One item—level of school collaboration with family—was removed from this domain.

Technical Infrastructure Domain

The 22 technical infrastructure items included in the initial draft were also approved by unanimous expert consensus; items in this domain comprised intelligent reporting and data analytics, data acquisition/entry and storage, user profile creation, data structuring, exchange and integration capabilities, multi-level user management, graphical presentation of analysis results, content personalization, data change tracking/logging, interactive education, and items related to scalability, security, and confidentiality. Additionally, capabilities such as offline support, modular architecture, stable performance, data encryption, compliance with ethical principles and informed consent, and dual

application/web functionality were endorsed. One item—support for data structure based on minimum set of data elements—was removed from this domain.

Discussion

In the present study, a comprehensive and holistic set of essential data elements and technical infrastructure requirements for an application- and web-based electronic student personal health record was identified through a rigorous document review and expert validation process. The concurrent engagement of content and technical experts from the fields of school health and electronic health records not only enhanced methodological rigor but also reinforced the practicability of the proposed framework. This dual-focus approach is congruent with contemporary methods for developing minimum data sets (MDS) that emphasize the integration of multidisciplinary perspectives [21]. Moreover, this approach aligns with prior Iranian efforts to establish data standards for student health records, where 271 data elements were ultimately approved through a multi-step Delphi process involving diverse expert panels [18].

According to the study results, 75.6% of the data elements related to student demographic variables and family-related variables were validated, a finding consistent with other studies employing various MDS development approaches [22]. The documentation of such information represents a foundational prerequisite for the development of electronic health records, facilitates necessary secondary analyses, and enables record linkage within electronic health record databases [31]. Sadeghi and colleagues similarly emphasized the importance of recording demographic and family data in a registry for childhood malnutrition [23]. Comparative studies examining student health measurement records across countries including the United States, England, and Australia have likewise identified demographic and societal information as a core category alongside medical examinations and physician assessments [32].

Expert consensus and emphasis on recording anthropometric data elements as well as items related to students' physical health—such as histories of various illnesses and physical disorders—in the student electronic personal health record align with the overarching view that these data are instrumental for preventive care and management of existing conditions. Studies that have focused on minimum data sets for student and university health records have likewise reported these variables as core components of essential data element sets [15, 33]. The inclusion of comprehensive physical health parameters enables early identification of health risks and facilitates timely interventions, which is particularly critical given the developmental vulnerabilities of school-aged populations.

Among all identified domains, mental health exhibited one of the highest levels of expert agreement. The approval of 83.3% of the proposed mental-health items by the experts indicates broad recognition of the central role of mental health in students and the school environment. This finding is particularly significant given the escalating global burden of mental disorders among children and adolescents. The World Health Organization reports that one in every seven adolescents has a mental health disorder, and

major contributors to rising mental health issues include academic stress, poor family interaction, peer pressure, increased screen time, and substance abuse [34]. Suicide, a grim manifestation of depression, is the fourth leading cause of death among adolescents [34]. Kieling et al., in a study examining the burden of disability attributable to mental disorders, similarly emphasized that approximately one quarter of the lifetime burden of mental disorders originates in childhood and adolescence—a period largely spent in school settings—underscoring the imperative to address this domain within student health records [24, 25]. Research on Iranian student health records has similarly concluded that more details related to mental health should be added to the personal health record data set and that existing student health certificates are incomplete and require modification [18].

The delineation of spiritual health as an independent and influential domain in student health records represents an innovation of the present study. This decision is grounded in empirical evidence linking spiritual health components with psychological resilience, and the experts' endorsement of including corresponding data elements further supports its relevance to comprehensive student health [26]. Although prior data-element determination studies have rarely addressed this dimension, international research increasingly endorses a holistic perspective on health that transcends the religious-secular binary boundaries. Spirituality has been shown to contribute to holistic wellness in children and adolescents by fostering a sense of compassion and love and enabling understanding of relationships with other living and non-living things [34]. Systematic literature reviews have demonstrated that spiritual health serves as a mediator in the association between adverse events and mental well-being, with mental health significantly influencing both psychological and physical health issues and necessitating appropriate therapeutic interventions to enhance adolescents' spiritual well-being [35]. Therefore, the present findings extend the scope of school health records beyond conventional biomedical models toward a more comprehensive, holistic health paradigm.

The data elements within the domains of nutrition, sleep, and physical activity—which interactively influence students' daily health behaviors [29]—constituted 21.5% of the total approved data elements, underscoring the importance of these domains for student health. Existing literature on electronic health records and studies that have delineated essential data elements for health systems and health-focused applications have similarly emphasized these information domains and their roles in the control, management, and prevention of health issues [13, 30]. Research has demonstrated that school-based digital health interventions are effective in improving physical activity, dietary intake, and multiple lifestyle behaviors [16]. Moreover, integrating wearable devices and smartphone applications into school health services has been shown to be highly acceptable among students, parents, and health teachers, with stress management, body shape management, and expert individual prescriptions identified as preferred areas of participation [36].

The necessity of documenting students' social health data for the purpose of identifying behavioral and social risks related to health and hygiene was affirmed by the majority of experts. Empirical studies indicate that social health and social support exert protective effects against mental health problems and contribute to wellbeing [31–33]; accordingly, the inclusion of these variables in our study aligns with

the objective of designing school-based social and behavioral interventions and may inform targeted, school-centered programs. Social support profiles have been shown to associate significantly with adolescents' psychological and academic functioning [31], and family communication as a component of social support protects adolescents against multiple recurrent health complaints related to school stress [32].

Emphasis on recording personal-hygiene data for students is also consistent with World Health Organization recommendations and prior research supporting the monitoring and improvement of hygienic behaviors in schools [37, 38]. Systematic documentation of personal-hygiene indicators can substantially enhance causal analysis and provide actionable feedback to promote students' health. School-based hygiene interventions have demonstrated significant reductions in infection-related absenteeism and improvements in hygiene knowledge and practices, with comprehensive water, sanitation, and hygiene (WASH) programs showing the most sustained impact by reducing diarrheal prevalence by up to 56% [5, 10].

The documentation of incidents and injuries occurring among students was another domain endorsed in the present study, a finding consistent with national documents and existing student health records in Iran, where considerable attention has been paid to this domain. In addition, the recording of school-related information—including school type, physical conditions, facilities, and educational programs—was identified as highly effective. International studies have likewise emphasized that structural school information is essential for designing interventions and allocating resources to promote student wellbeing, which in turn influences health outcomes; these findings are aligned with those of the present study [39]. Modern health management approaches in educational institutions increasingly integrate preventive health concepts with digital technologies such as artificial intelligence for health screening and environmental control [40].

The emphasis placed by technical experts on modular architecture, data interoperability, and the user-friendliness of the electronic student health record reflects international trends in defining technical requirements and infrastructures for health-oriented information systems. Moreover, the proposed capabilities for intelligent data analysis and reporting, alongside access control, privacy protection, and security measures, are consistent with existing studies on the quality and accountability of health information systems [41, 42]. Interoperability—the capability of different IT systems to communicate and exchange data effectively—remains a critical challenge, as educational data maintained in student information systems are often not interoperable with electronic health records used in the healthcare sector. The lack of adherence to common health data standards by school EHRs complicates data-sharing, making it inefficient, error-prone, and sometimes impossible [43]. Adoption of school EHRs designed with widely recognized healthcare data standards such as LOINC, SNOMED CT, and HL7 FHIR is essential for promoting interoperability [43]. Collectively, the technical infrastructures endorsed in this study enhance scalability and facilitate the nationwide implementation of an electronic student health record system.

Limitations

Among the limitations of this study is that the validation of data elements and technical infrastructures was conducted solely based on expert opinion, with participants recruited through convenience sampling; this may have influenced the diversity of perspectives captured and the generalizability of the findings. Furthermore, due to the descriptive-developmental nature of the study, the proposed framework was not evaluated in terms of usability, end-user acceptance, or technical performance in real-world settings.

Conclusion

The data requirements and technical infrastructure identified in this study could provide an evidence-based foundation for the development of national standards and the design of electronic student health records. By strengthening surveillance, evaluation, and targeted interventions, this framework may facilitate data integration and inform policy-making in the field of student health. The comprehensive nature of the proposed data elements—spanning demographic, physical, mental, spiritual, social, nutritional, physical activity, sleep, hygiene, and school-related domains—positions this framework as a holistic tool for student health management that extends beyond the biomedical model. Nevertheless, field-based and longitudinal studies are required to confirm its effects on health outcomes and academic performance. Future research should focus on evaluating the usability, acceptability, and practical implementation of this framework in diverse educational settings, as well as assessing its impact on health outcomes, academic performance, and user engagement.

Declarations

Ethics approval and consent to participate:

The project was found to be in accordance to the ethical principles and the national norms and standards for conducting Medical Research in Iran. The study protocol was approved by the Ethics Committee of the School of Medical Sciences of Esfarayen (IR.ESFARAYENUMS.REC.1404.015). All experts provided informed consent prior to participation. The confidentiality of expert responses was maintained throughout the study, and data were anonymised during analysis. We are not reporting experiments on live subjects.

Conflict of Interest:

The authors declare that they have no financial or non-financial conflicts of interest related to this study.

Generative AI Statement

During the preparation of this manuscript, the authors used DeepSeek (DeepSeek AI) for language refinement and editing to improve the clarity and readability of the text. After using this tool, the authors carefully reviewed, revised, and verified the entire content to ensure accuracy and take full responsibility for the integrity and originality of the published work.

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Author Contribution

A.S. and K.Q. wrote the main manuscript text and F.M prepared charts and table. All authors reviewed the manuscript.

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Data Availability

Data availability: The datasets generated during and/or analyzed during the current study are available from the corresponding author (KQ) and Dr. Ahmadreza Shamsabadi on reasonable request. All methods were carried out in accordance with relevant guidelines and regulations.

References

1. Patel, R. S. Maintaining Personal Health and Family Life. In: A Radiologist's Path: What to Expect after a Radiology Residency. Springer; 269–270. (2025).
2. Haapala, E. A. et al. Childhood Lifestyle Behaviors and Mental Health Symptoms in Adolescence. *JAMA Netw. Open.* **8** (2), e2460012 (2025).
3. Curtis, V. & Cairncross, S. Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *Lancet. Infect. Dis*. **3** (5), 275–281 (2003).

4. Ross, I. et al. Effectiveness of handwashing with soap for preventing acute respiratory infections in low-income and middle-income countries: a systematic review and meta-analysis. *Lancet* **401** (10389), 1681–1690 (2023).
5. Ismail, S. R. et al. The effects of school-based hygiene intervention programme: Systematic review and meta-analysis. *PLoS ONE*. **19** (10), 1–20 (2024).
6. Afandi, N. A., Fattah, N., Rasfayanah, R., Darussalam, A. H. E. & Aisyah, W. N. Personal Hygiene and Soil-Transmitted Helminth Infection Among School Children in Karuwisi Health Centre Area, Makassar. *Healthy Tadulako J.* **11** (4), 681–690 (2025).
7. Irfan, O., Li, J., Tang, K., Wang, Z. & Bhutta, Z. A. Risk of infection and transmission of SARS-CoV-2 among children and adolescents in households, communities and educational settings: A systematic review and meta-analysis. *J. Global Health*. **11**, 05013 (2021).
8. Rohmah, F. A., Setiawan, R., Adriyani, R. & bin Mohd, S. Personal Hygiene as a Risk Factors of Helminthiasis Among Primary School Students in Asia and Africa: A Literature Review. *J. Environ. Health*. **14** (3), 139–152 (2022).
9. Pulimeno, M., Piscitelli, P., Colazzo, S., Colao, A. & Miani, A. School as ideal setting to promote health and wellbeing among young people. *Health Promotion Perspect.* **10** (4), 316–324 (2020).
10. Gholamrezaee-Sarvelat, Z., Khoshsourat, J. & Taheri-Kharameh, Z. School Hygiene and Student Health Outcomes: A Review of Global Interventions. *Archives Hygiene Sci.* **14** (4), 157. 10.22034/AHS.14.4.157 (2025).
11. Lin, J. et al. Integrating Mobile Health App Data Into Electronic Medical or Health Record Systems and Its Impact on Health Care Delivery and Patient Health Outcomes: Scoping Review. *JMIR Mhealth Uhealth*. **13**, e66650 (2025).
12. Wang, J-W. et al. Effectiveness of mHealth app–based interventions for increasing physical activity and improving physical fitness in children and adolescents: Systematic review and meta-analysis. *JMIR mHealth uHealth*. **12** (1), e51478 (2024).
13. França, C. et al. *Digit. Health Schools: Syst. Rev. Sustain.* ;**14**(21):13848. (2022).
14. Singh, B. et al. Lifestyle eHealth and mHealth Interventions for Children and Adolescents: Systematic Umbrella Review and Meta–Meta-Analysis. *J. Med. Internet Res.* **27**, e69065 (2025).
15. Champion, K. E. et al. Health4Life eHealth intervention to modify multiple lifestyle risk behaviours among adolescent students in Australia: a cluster-randomised controlled trial. *Lancet Digit. Health*. **5** (5), e276–e287. 10.1016/S2589-7500(23)00028-6 (2023).
16. Talens, C. et al. Mobile- and Web-Based Interventions for Promoting Healthy Diets, Preventing Obesity, and Improving Health Behaviors in Children and Adolescents: Systematic Review of Randomized Controlled Trials. *J. Med. Internet. Res.* **27**, e60602 (2025).
17. McDonough, R. P. et al. Determining essential elements and functionalities for a patient record system in community pharmacy. *J. Am. Pharmacists Association*. **64** (2), 499–505 (2024).
18. Samadpour, H. & Sadoughi, F. Data Set of Electronic Personal Health Records for Iranian Students of Medical Sciences. *Health Inform. Manage.* **12** (4), 425 (2015).

19. Nabovati, E., Rangraz Jeddi, F., Tabatabaeizadeh, S. M., Hamidi, R. & Sharif, R. Design, development, and usability evaluation of a smartphone-based application for nutrition management in patients with type II diabetes. *J. Diabetes Metab. Disord*. **22** (1), 315–323 (2023).
20. Litke, S. G. et al. Mobile Technologies for Supporting Mental Health in Youths: Scoping Review of Effectiveness, Limitations, and Inclusivity. *JMIR Ment Health*. **10**, e46949 (2023).
21. Rezaei, P., Kaveh, H. & Azad, P. Developing a Framework for Electronic Health Record of Students: A Case Study of West Azerbaijan Province Schools. *Mod. Appl. Sci.* **10**, 171 (2016).
22. Milne-Ives, M., Homer, S. R., Andrade, J. & Meinert, E. Potential associations between behavior change techniques and engagement with mobile health apps: a systematic review. *Front. Psychol.* **14**, 1227443 (2023).
23. Montazeri, M. et al. Developing a minimum data set for cardiovascular Computerized Physician Order Entry (CPOE) and mapping the data set to FHIR: A multi-method approach. *J. Med. Syst.* **47** (1), 47. 10.1007/s10916-023-01943-2 (2023).
24. Kazemi-Arpanahi, H., Vasheghani-Farahani, A., Baradaran, A., Mohammadzadeh, N. & Ghazisaeedi, M. Developing a minimum data set (MDS) for cardiac electronic implantable devices implantation. *Acta Inf. Med.* **26** (3), 164–168. 10.5455/aim.2018.26.164-168 (2018).
25. HL7 International. Gravity Terminology Process to Develop Consensus-Based Standards. Available at: https://confluence.hl7.org/pages/viewpage.action?pageId=91996278
26. Greenhalgh, T. et al. Adoption, non-adoption, and abandonment of a personal electronic health record: case study of HealthSpace. *BMJ* **341**, c5814 (2010).
27. Abbasi, M., Ahmadian, L., Amirian, M., Tabesh, H. & Eslami, S. The development of a minimum data set for an infertility registry. *Perspect. Health Inf. Manag* ;**15**(Winter). (2018).
28. Lawshe, C. H. A quantitative approach to content validity. *Pers. Psychol.* **28** (4), 563–575 (1975).
29. Shanbehzadeh, M. & Kazemi-Arpanahi, H. Development of minimal basic data set to report COVID-19. *Med. J. Islam Repub. Iran.* **34**, 111 (2020).
30. Direito, B. et al. Design and Implementation of a Collaborative Clinical Practice and Research Documentation System Using SNOMED-CT and HL7-CDA in the Context of a Pediatric Neurodevelopmental Unit. *Healthcare* **11** (7), 973. 10.3390/healthcare11070973 (2023).
31. Chan, M. K., Sharkey, J. D., Nylund-Gibson, K., Dowdy, E. & Furlong, M. J. Social support profiles associations with adolescents' psychological and academic functioning. *J. Sch. Psychol.* **91**, 160–177 (2022).
32. Safdari, R., Mohammadzadeh, N., Bahmanziari, N. & Gheibi, N. A Comparative Study of the Minimum Data Set of Novice Students' Health Measurement Records in Some Selected Countries and Presenting a Model for Iran. *J. Clin. Res. Paramed Sci.* **6** (2), 201–209 (2017).
33. Montazeri, M. et al. Developing a minimum data set for cardiovascular Computerized Physician Order Entry (CPOE) and mapping the data set to FHIR: A multi-method approach. *J. Med. Syst.* **47** (1), 47 (2023).

34. Khalatkar, V. Nurturing Mental and Spiritual Health in Children. *Indian Pediatr.* **62**, 553 (2025).
35. Mohd Manawi Mohd Akib. Systematic Literature Review of the Impact of Islamic Psychotherapy on Adolescent Spiritual Well-Being. *J. Relig. Health*. **64** (5), 3365–3405 (2025).
36. Kim, H. et al. Development of a Smart Health Care Service Using Metaverse and Chatbot Technologies for Adolescents, Parents, and School Health Teachers: User-Centered Design Approach. *J. Med. Internet Res.* **27**, e69190. 10.2196/69190 (2025).
37. Pérez Pico, A. M., Mingorance Álvarez, E., Villar, R. J. & Mayordomo Acevedo, R. Differences in Hygiene Habits among Children Aged 8 to 11 Years by Type of Schooling. *Children* **9** (2), 129 (2022).
38. Minda, G. H., Tola, H. H., Amhare, A. F., Kebie, A. & Endale, T. Personal hygiene practice and associated factors among elementary school students in Fiche Town, Oromia, Ethiopia. *BMC Infect. Dis.* **24** (1), 781 (2024).
39. Tapia-Fonllem, C., Fraijo-Sing, B., Corral-Verdugo, V., Garza-Terán, G. & Moreno-Barahona, M. School Environments and Elementary School Children's Well-Being in Northwestern Mexico. *Front. Psychol.* **11**, 567 (2020).
40. Mataneedol International School. *Well-being in Modern Schools: Health Management Approaches through AI and Social Media [case study]* (Airiti Library, 2025).
41. Casanova, R., Villa-Garzon, F. A. & Branch-Bedoya, J. W. Architectural patterns for health information systems: a systematic review. *Front. Digit. Health*. **7**, 1694839 (2025).
42. Torab-Miandoab, A., Samad-Soltani, T., Jodati, A., Akbarzadeh, F. & Rezaei-Hachesu, P. A unified component-based data-driven framework to support interoperability in the healthcare systems. *Heliyon* **10** (15), e35036 (2024).
43. Public Health Accreditation Board (PHAB). Enhancing School Health through Data Collaborations: A Guide for School Health Leaders and Decision-Makers. (2024). Available at: https://phaboard.org/wp-content/uploads/c4shiq_data-sharing_r6.pdf

Figures

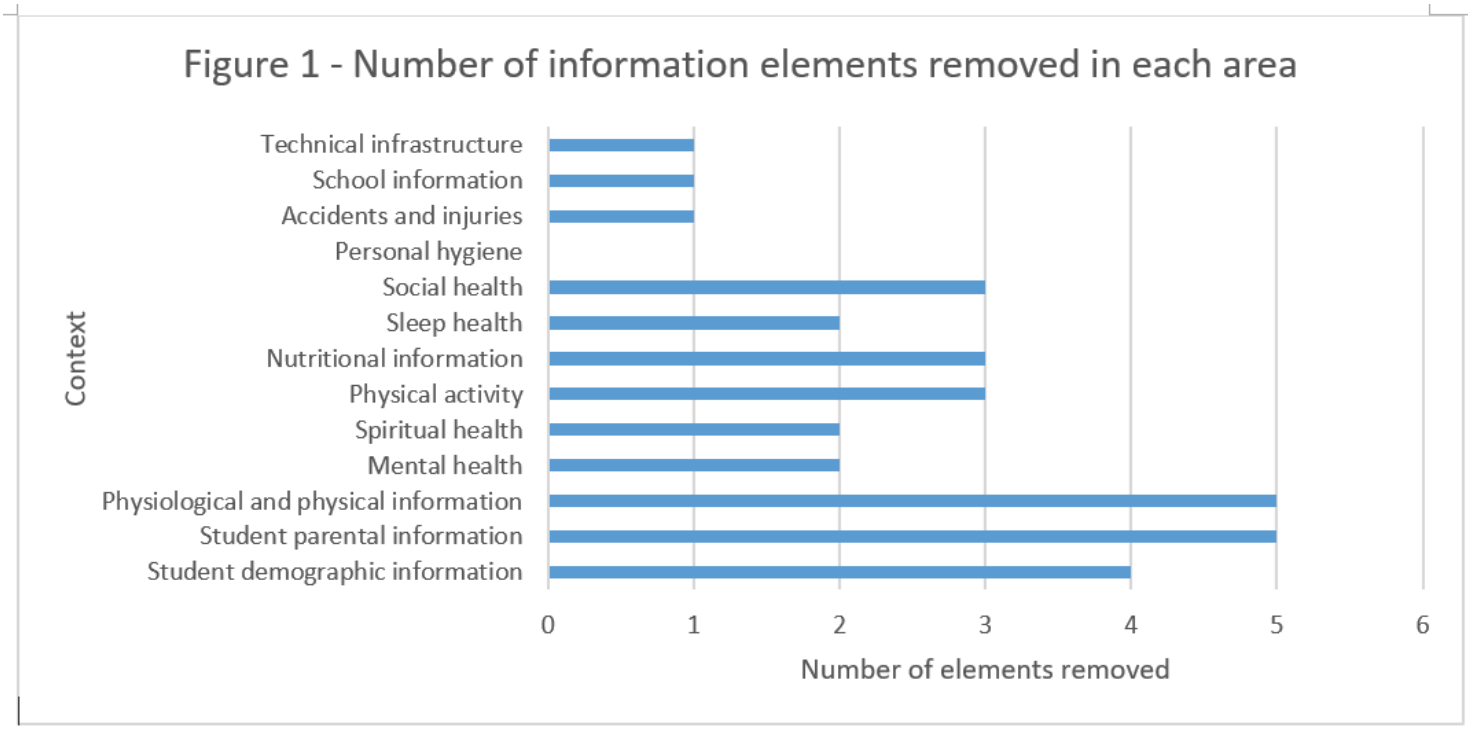


Figure 1

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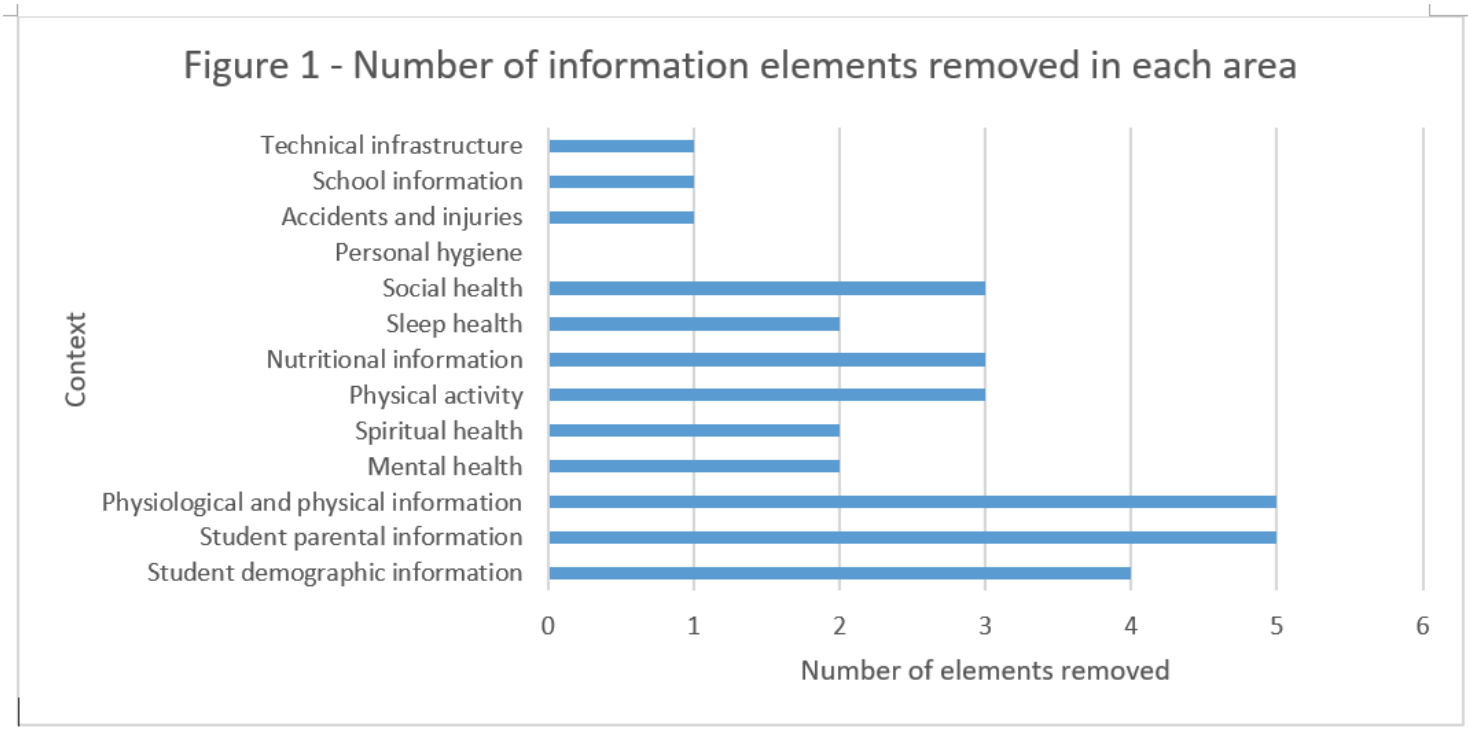


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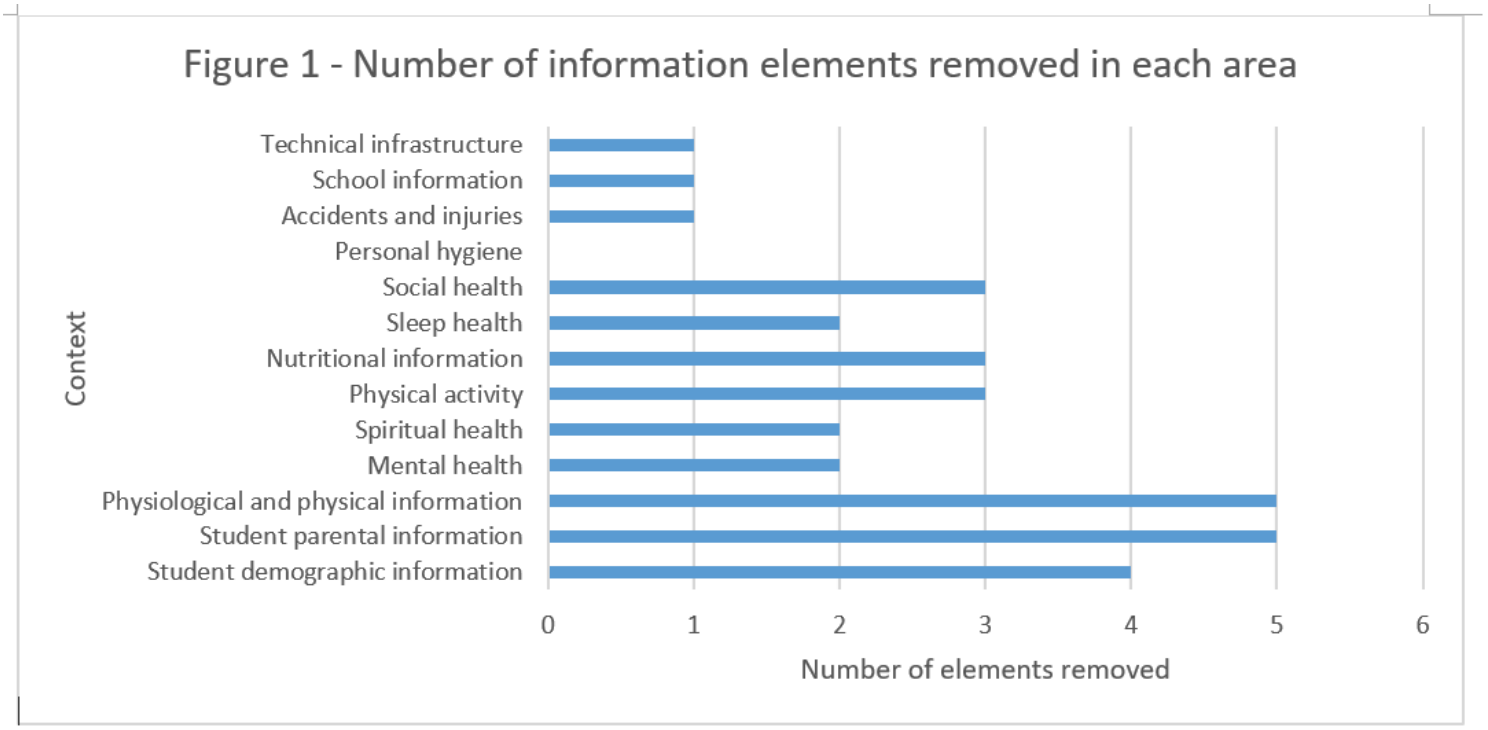


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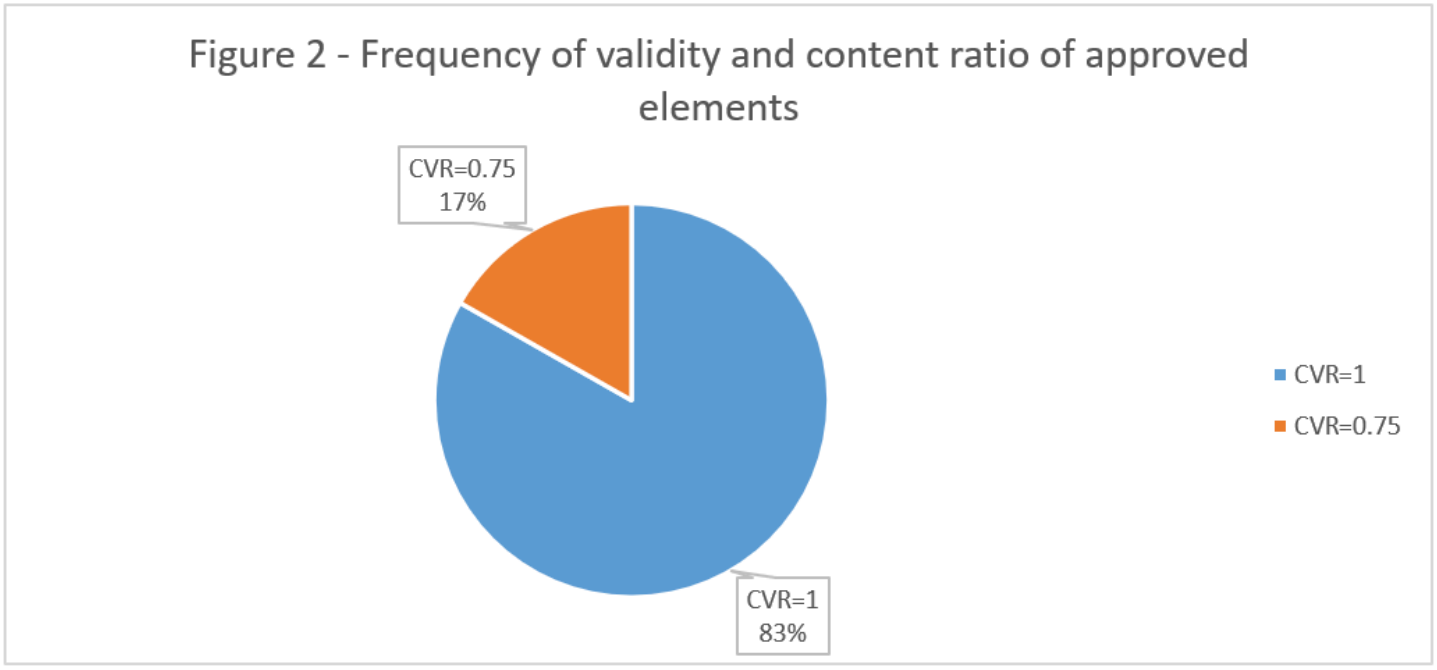


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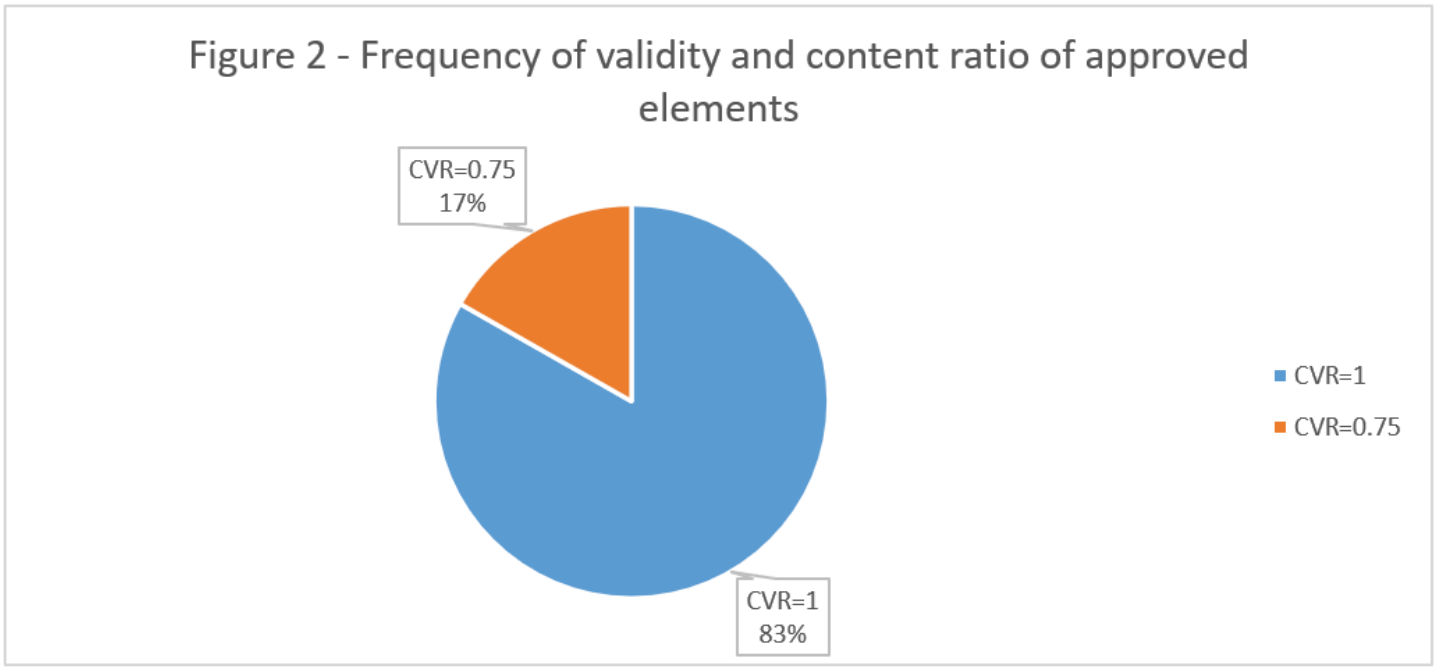


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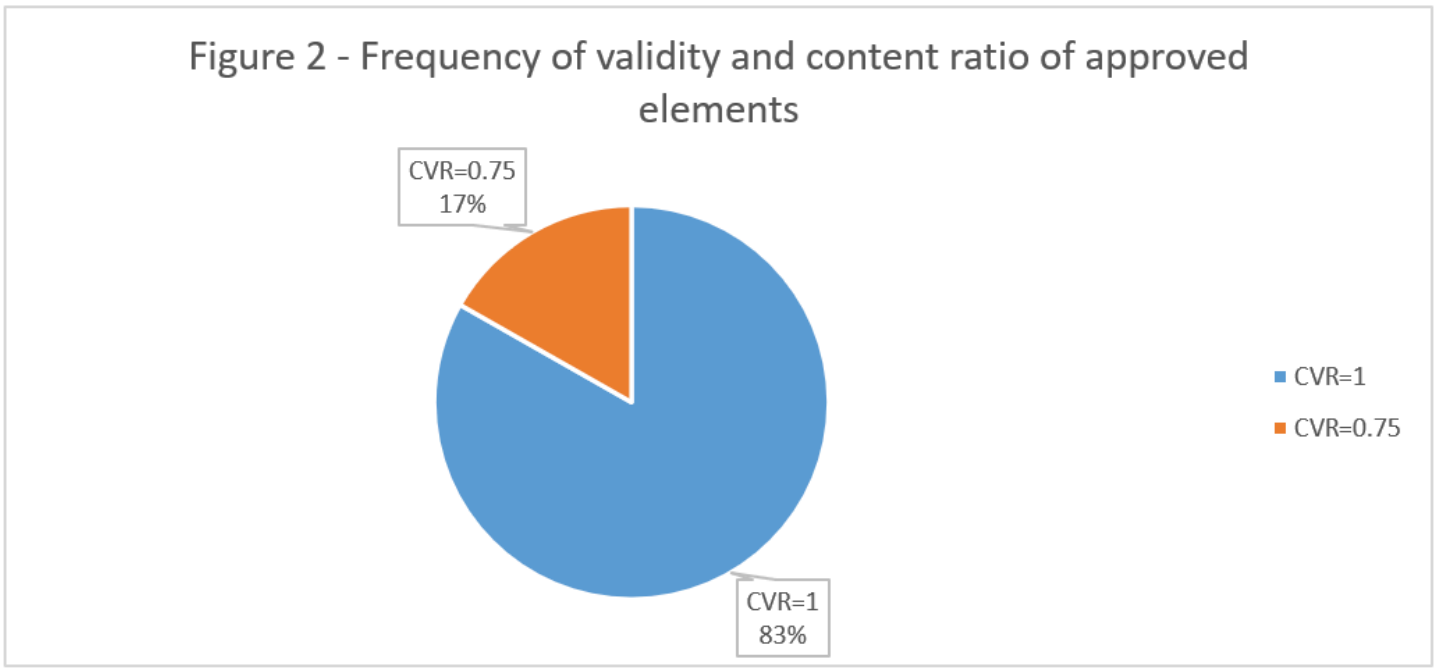


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- Appendix1ChecklistofMinimumDataSet.docx
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- Appendix1ChecklistofMinimumDataSet.docx
- Appendix2RemovedInformationElements.docx
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