The Journal of School Nursing

Prevalence of chronic diseases, allergies and food intolerance in schoolchildren in a network of educational centers with school nurses in Spain.

Journal:	*The Journal of School Nursing*
Manuscript ID	JSN-24-10-266.R2
Manuscript Type:	Original Research Reports
Keywords:	Chronic Diseases, Allergies, Food intolerance, School nursing

Abstract:	The prevalence of chronic diseases, including allergies, is increasing in schoolchildren, making school nurses essential in managing students' health. This study aimed to determine the prevalence of chronic conditions in schoolchildren within a network of Spanish educational centers with school nurses. A descriptive cross-sectional study of 25,951 students attended by SchoolNurses® in May 2023 was performed. Schoolchildren and educational center data were collected from the SNapp school health records, a management platform developed by SchoolNurses® to document health information and nursing activities. Mean age of students was 10.11 years (50.20% female). A total of 9.45% had chronic disorders, including disorders of the respiratory (4.14%), neurological (2.94%), digestive (2.28%), musculoskeletal (1.25%), and cardiovascular (1.14%) systems. A total of 12.5% had allergies (6.10% food allergies), and 2.81% had food intolerances. Identifying and recording these diseases are key responsibilities of the school nurse, supporting improved care quality and informing policies to ensure school nurse availability and enhanced health management protocols for students.

RESPONSE TO EDITOR AND REVIEWER'S COMMENTS

The authors of the manuscript would like to thank the publishing editor, the editorial team and the reviewers for their valuable feedback. We have made the suggested changes to ensure clarity and alignment with the publication's standards. Please, find below the responses to each of the editor and reviewer's comments.

Editor's Comments:

After discussion with the publishing editor and the editorial team, we are asking

- that the commercial trademarked name of the software company be removed from the abstract

We have removed the commercial trademarked name of the software company from the abstract as suggested.

- the description of the software in the methods be shortened to what is pertinent to the collection of data - a suggested edit is in the attached edited manuscript

We have shortened the description of the software in the methods section to what is pertinent to the collection of data as requested.

- in the limitations section, state something to the effect of the data was collected from one software program

Thank you for your suggestion. We have added a sentence in the limitations section to state that the data was collected from a single software program.

- in the discussion section, state something about the value of documentation programs / electronic health records in schools and not call out this particular program since all SN doc programs should be able to generate this kind of data.

Thank you for your suggestion. We have revised the discussion section to emphasize the value of documentation programs and electronic health records in schools, without referring to any specific program.

- the association with one of the authors with the software company be acknowledged in the following statement Declaration of Conflicting Interest: Jesús Ruiz Janeiro holds (name of his position) at SchoolNurses.es

We have made the requested change and included the association of Jesús Ruiz Janeiro with the software company in the "Declaration of Conflicting Interest" statement as requested.

I attached a copy-edited manuscript that has some additional suggestions and questions. Please make all changes on that document and highlight the changes made.

Thank you for the copy-edited manuscript. We have reviewed the suggestions and questions provided and made all the necessary changes to the document. The revisions have been made with tracked changes for your easy reference.

Reviewer(s)' Comments:

• Stating in the limitations that the data came only from that program and other documentation programs could have different results or could even make data collection and analysis easier

Thank you for your suggestion. We have revised the limitations section to incorporate both your feedback and the editorial team's feedback.

• Identifying what other documentation programs are used in Spain for this purpose - give a general discussion of the value documentation programs vs this particular program since all SN doc programs should be able to generate this kind of data.

Currently, this is the only software available for school nurses in Spain for managing student health and nursing activities and there are no other comparable programs specifically designed for this purpose at the moment. While this study focuses exclusively on data from centers within the SchoolNurses® network that use this program, similar documentation programs are used internationally to manage student health data. These systems share the common goal of supporting school health management and improving care for school-aged children, and other programs could yield different results or facilitate data collection and analysis in unique ways.

We have given a general discussion of the value documentation programs vs this particular program in the Discussion Section.

• what is the prevalence of use of this program in the whole population of Spain

The use of SNapp.care is currently implemented in the 51 schools within the SchoolNurses® network, along with a few external schools (approximately four) and one school in Mexico, which was not included in this study. Despite offering a free version of the software for any school to use, widespread adoption has been limited. Many school nurses from public schools in Spain have expressed interest in using the program; however, the Ministry of Education and Ministry of Health currently does not allow its use, requiring that all data remain within their own school/health platforms.

• Perhaps a general discussion of the SN doc programs internationally (Or maybe just Europe) just to make clear that this particular program is not unique in its use for comprehensive health data on school aged children. It can be

misleading if only this particular program is discussed like its something special.

The use of documentation programs and electronic health records in schools by school nurses is essential for efficiently tracking students' health data, enabling the collection of valuable information on chronic conditions, allergies, and other health-related factors. These systems support data management, facilitate the analysis of student health trends and enable informed decision-making to improve health services in the school setting. They also enhance care quality by providing timely access to relevant data, improving communication among school staff, and ensuring continuity of care. While this study focuses exclusively on data from centres within the SchoolNurses® network that use this program, similar documentation programs are used internationally to manage student health data. These systems share the common goal of supporting school health management and improving care for school-aged children, and other programs could yield different results or facilitate data collection and analysis in unique ways.

We have addressed this broader perspective on documentation programs in the 'Discussion' section of the manuscript to clarify that SNapp is one of many tools serving a similar essential function in school health management worldwide.

Editing Certificate

This document certifies that the manuscript

Prevalence of chronic diseases, allergies and food intolerance in schoolchildren in a network of educational center

prepared by the authors

Jaime Barrio Cortes, Beatriz Benito-Sánchez, Anaís Núñez-Mata, Cristina Lozano-Hernández, María Díaz-Quesada, Ángel Vicario Merino, Jesús Ruiz Janeiro, Cayetana Ruiz-Zaldivar

was edited for proper English language, grammar, punctuation, spelling, and overall style by one or more of the highly qualified English speaking editors at AJE.

This certificate was issued on September 27, 2024 and may be verified on the AJE website using the verification code 4C7A-B759-0C8B-673E-A620.

Neither the research content nor the authors' intentions were altered in any way during the editing process. Documents receiving this certification should be English-ready for publication; however, the author has the ability to accept or reject our suggestions and changes. To verify the final AJE edited version, please visit our verification page at aje.com/certificate.
If you have any questions or concerns about this edited document, please contact AJE at support@aje.com.

Original Research Report

TITLE: Prevalence of chronic diseases, allergies and food intolerance in schoolchildren in a network of educational centers with school nurses in Spain.

ABSTRACT

The prevalence of chronic diseases, including allergies, is increasing in schoolchildren, making school nurses essential in managing students' health. This study aimed to determine the prevalence of chronic conditions in schoolchildren within a network of Spanish educational centers with school nurses. A descriptive cross-sectional study was conducted in May 2023, covering 25,951 students from these centers. Schoolchildren and educational center data were collected from the school health records to document health information and nursing activities. Mean age of students was 10.11 years (50.20% female). A total of 9.45% had chronic disorders, including disorders of the respiratory (4.14%), neurological (2.94%), digestive (2.28%), musculoskeletal (1.25%), and cardiovascular (1.14%) systems. A total of 12.5% had allergies (6.10% food allergies), and 2.81% had food intolerances. Identifying and recording these diseases are key responsibilities of the school nurse, supporting improved care quality and informing policies to ensure school nurse availability and enhanced health management protocols for students.

KEYWORDS

Chronic diseases, Allergies, Food intolerance, School nursing.

INTRODUCTION

Chronic diseases in children and adolescents include various long-term health conditions that are incurable or resistant to treatment, often requiring ongoing medical care and significantly impacting a child's quality of life and development. In a systematic review by van der Lee et al. (2007), chronic disease in children is defined as a condition persisting for 12 months or more. This review highlights the considerable variation in definitions and criteria across studies, complicating accurate prevalence estimates. Furthermore, many epidemiological studies on chronic diseases in children and adolescents are limited or outdated. For instance, Van Cleave et al. (2010), reported in the United States prevalence rates increasing between 13% in 1994 to 27% in 2006, while Denny et al. (2014) found a prevalence of 18% in New Zealand. In contrast, a systematic review published in 2007 reported a broader range for the prevalence of chronic disease in children, spanning from less than 10% to almost 50% across other countries, including Great Britain, France, Switzerland, Finland, Sweden, Israel, Jordan or Saudi Arabia (van der Lee et al., 2007).

Additionally, allergies are another significant chronic health issue in children, characterized by an exaggerated immune response triggered by exposure to specific allergens, typically managed by avoidance. There are several types of allergies, such as food allergies, where the immune system reacts to proteins in certain foods, and drug allergies, triggered by medications. Environmental allergens such as pollen, dust mites, or pet dander also cause allergies. Symptoms range from mild (e.g., hives, rashes, itching, and swelling) to severe (e.g., difficulty breathing, anaphylaxis). Food allergies represent one of the most prevalent health problems in children and can have significant negative repercussions not only for children's health but also for their academic performance (Kalra & Kalra, 2024; Feldman et al., 2022; Dyer & Gupta, 2013; Miller et al., 2016; Rona et al., 2007). Prevalence estimates vary widely because few epidemiological studies use standardized diagnostic methods, which may lead to overestimating the true prevalence (Nwaru et al., 2014; Rona et al., 2007).

According to a 2018 review, the prevalence of food allergies could be as high as 10%, with food allergies being more common in children. The highest disease burdens are attributed to specific foods such as nuts, fish, shellfish, eggs, milk, wheat, soybeans, and seeds (Sicherer & Sampson, 2018). As food allergy rates rise, it is necessary to obtain updated prevalence from current data (Spolidoro et al., 2023). Unlike allergies, food intolerance involves problems with enzymes or the function of the digestive system and includes lactose or gluten intolerance (Tuck et al., 2019).

These chronic conditions can worsen and potentially lead to health emergencies in schools, particularly when children encounter triggers or stressors such as infections, allergens, or temperature changes. The lack of proper identification, along with insufficient resources and insufficient staff training, can endanger the students' health (Gómez Silva et al., 2020). In Spain, over half of the children aged 3 to 12 years have lunch at school (Alonso Lebrero & Alonso Lebrero, 2011), with up to 25% of anaphylactic reactions occurring for the first time in school settings (White et al., 2016). Alarmingly, schools also report the most severe food allergies reactions and fatalities (Gómez Silva et al., 2020). Chronic diseases and allergies also have broader impacts, significantly affecting children's mental health and increasing their vulnerability to bullying and social isolation (Kalra & Kalra, 2024). These conditions cause academic disruptions, with frequent absences, reduced concentration, and the need for medical interventions hindering learning and academic success. Consequently, these chronic diseases not only hinder educational achievements but also diminish the overall quality of life for affected children (Centers for Disease Control and Prevention, 2017).

It is essential to establish coordinated strategies between educational centers and health professionals to ensure the safety and adequate care of students in the school environment (Gómez Silva et al., 2020). This need arises due to the frequency of emergencies resulting from epileptic seizures, asthma exacerbations, or glycemic alterations, among other

problems (Gereige et al., 2022). School nurses play an important role in identifying chronic diseases and promoting the health and safety of students. Their awareness of the growing prevalence of chronic diseases and allergies among schoolchildren is essential for delivering higher-quality, individualized care (Twichell et al., 2015). Furthermore, school nurses can implement programs that not only manage these chronic conditions but also educate students and staff, creating a healthier school environment. Studies have shown that school nurse interventions are cost-effective in improving students' health outcomes (Wang et al., 2014). By leveraging their expertise and collaborating with educational institutions, school nurses can ensure timely support for students with chronic health issues. This study showcases the role of school nurses in detecting and managing chronic diseases within the school setting to enhance health outcomes and foster resilience in students, aligning with McEwen and Wills (2023) recommendation that applying nursing theory can create a pathway toward targeted health improvements. By integrating school nurses into the study methodology, the research supports a framework that encourages proactive, holistic care to improve children's health and academic success.

Despite disparities in prevalence estimates, all studies show that the prevalence of chronic pediatric diseases in general and allergies, in particular, is increasing (Perrin et al., 2014). However, there are limited studies addressing these conditions in the school environment. Therefore, new prevalence estimates based on recent data from a diverse, large sample of students provide a broad representation, allowing cautious generalization to the wider school-age population and reflecting the current reality of these conditions in schools. This study aims to determine the prevalence of chronic diseases and allergies among schoolchildren in a network of educational centers with a school nurse in Spain and to analyze these prevalence rates by sex and school level.

METHODS

Study design. Descriptive observational cross-sectional study.

Institutional review board approval. This study was approved by the Ethics Committee of Camilo José Cela University. Dissociated and anonymized data were evaluated in this study, and the current legislation and internal regulations on data protection of the SchoolNurses® company were respected (School Nurses, 2022a).

Setting and population. This study included 49 schools in Spain, which employed 51 school nurses through the company SchoolNurses® (School Nurses, 2022a). Of the educational centers studied, 33 were subsidized by regional governments, and 16 were private. A total of 25,951 students were enrolled in these schools in May 2023.

Procedures described. The schoolchildren's data were extracted from the SNapp.care management platform. This tool was created by SchoolNurses® to facilitate the management and storage of school nursing services and students' sociodemographic and health data. There was no traditional sampling technique or response rate to report, as the dataset encompasses the entire population of students who attended schools with SchoolNurses® software at the time of data collection. To ensure data accuracy and reliability, SchoolNurses® follows strict legal guidelines requiring detailed health records from parents, verified and updated by school nurses, monitored through quality control procedures, and regularly audited for compliance, with records shared transparently with parents and school directors.

The study variables included students' sociodemographic characteristics (sex, age, and education level of the student [categorized as preschool students from 0 to 6 years, primary from 6 to 12 years, secondary from 12 to 16 years, baccalaureate from 16 to 18 years, and vocational education from 16 years]), type and province of the school, chronic disease (defined as including chronic respiratory diseases, neurological disorders, digestive diseases, musculoskeletal diseases, heart diseases, and autism spectrum disorder, all of which persist for longer than 12 months), allergies (defined as exaggerated immune response triggered by

exposure to specific allergens such as drugs, food - dried fruits, peanuts, egg, milk, cereals, fish, crustaceans, mollusks, lupins, sesame, soybeans, mustard, celery or sulfites – as well as unspecified allergies when allergens are not clearly identified), and food intolerance (defined as problems with enzymes or the function of the digestive system).

Statistical analysis. A descriptive analysis of each study variable was carried out for the overall sample of schoolchildren and for the resulting subgroups after segmenting by sex and school level. Qualitative variables are presented as frequencies and percentages, and quantitative variables are presented as the means and standard deviations. A bivariate analysis was performed by applying the chi-square test or Fisher's exact test to compare the categorical variables, whereas parametric and nonparametric tests were used to compare polytomous and quantitative variables, the distribution of which was determined by the Shapiro–Wilk test. The results of the comparisons were considered significant when $p < 0.05$. Statistical analysis was performed with IBM SPSS Statistics version 25 software (IBM Corp., Armonk, NY).

RESULTS

Sociodemographic Characteristics

Among the 25,951 schoolchildren in the study, 12,961 (50.20%) were female, with an average age of 10.11 years. The majority were in primary education (n = 11,039, 42.54%), followed by secondary education (n = 7,453, 28.72%) and preschool (n = 4,982, 19.20%). In lesser proportions, students were studying for high school (n = 2,132, 8.22%) and vocational training (n = 345, 1.33%). A total of 17,189 (66.24%) of the schoolchildren studied in a subsidized center, and 8,762 (33.76%) studied in a private center. The 49 centers under study were located across 11 different Spanish provinces within nine Spain´s 17 autonomous communities. Sociodemographic characteristics overall and by sex are shown in Table 1.

Table 1. Sociodemographic characteristics of the total population of schoolchildren studied and segmented by sex.

Characteristics n (%)	Total 25,951 (100)	95% CI	Female sex 12,961 (50.20)	Male sex 12,858 (49.80)	p
Age (standard deviation)	10.11 (4.45)	10.06-10.17	10.24 (4.46)	10.01 (4.42)	<0.001
School level					
Preschool	4,982 (19.20)	18.72-19.68	2,309 (17.81)	2,617 (20.35)	
Primary	11,039 (42.54)	41.94-43.14	5,589 (43.12)	5,421 (42.16)	<0.001
Secondary	7,453 (28.72)	28.17-29.27	3,725 (28.74)	3,706 (28.82)	
Baccalaureate	2,132 (8.22)	7.88-8.55	1,174 (9.06)	948 (7.37)	
Vocational education	345 (1.33)	1.19-1.47	164 (1.27)	166 (1.29)	
College					
State-subsidized	17,189 (66.24)	65.66-66.81	8,730 (67.36)	8,414 (65.44)	0.001
Private	8,762 (33.76)	33.19-34.34	4,231 (32.64)	4,444 (34.56)	
Province					
Madrid	16,806 (64.76)	64.18-65.34	8,514 (65.69)	8,216 (63.90)	
Tenerife	1,931 (7.45)	7.13-7.76	943 (7.28)	962 (7.48)	
Valencia	1,544 (5.95)	5.69-6.26	726 (5.60)	816 (6.35)	
Barcelona	1,439 (5.55)	5.67-6.24	739 (5.70)	687 (5.34)	
Toledo	996 (3.84)	3.60-4.07	483 (3.73)	511 (3.97)	0.036
Vizcaya	819 (3.16)	2.94-3.37	391 (3.02)	428 (3.33)	
Alicante	554 (2.05)	1.96-2.31	274 (2.11)	279 (2.17)	
Castellón	535 (2.06)	1.89-2.24	259 (2.00)	276 (2.15)	
A Coruña	531 (2.05)	1.87-2.22	265 (2.04)	265 (2.06)	
Sevilla	512 (1.97)	1.80-2.14	240 (1.85)	261 (2.03)	
Zaragoza	284 (1.10)	0.97-1.22	127 (0.98)	157 (1.22)	

Prevalence of Chronic Disorders

A total of 2,452 (9.45%) of the students had at least one chronic disorder, and this prevalence was statistically significantly higher in males (n = 1,325, 10.30%) vs. in females (n = 1,123, 8.66%) ($p < .001$) and significantly higher in those in secondary education (n = 776, 10.41%), followed by those in the primary (n = 1,079, 9.77%) and baccalaureate stages (n = 196, 9.19%) ($p < .001$). The most frequently affected system was the respiratory system, with 1,074 cases (4.14%), with a higher prevalence in males (n = 624, 4.85%) vs. in females (n = 446, 3.44%) ($p < .001$) and significantly higher among those studying the primary (n = 493, 4.47%) and baccalaureate stages (n = 92, 4.32%) ($p = .001$). Other affected systems included the neurological (n = 762, 2.94%), digestive (n = 592, 2.28%), musculoskeletal (n = 325, 1.25%), and cardiovascular systems (n = 297, 1.14%). Autism spectrum disorder was reported in 75 students (0.29%), which was significantly more frequent in males (n = 63, 0.49%) vs. in females (n = 12, 0.09%) ($p < .001$). The chronic diseases of the schoolchildren population and segmented by sex and school level are shown in Table 2 and Table 3.

Table 2. Prevalence of chronic diseases present in the total population of schoolchildren studied and segmented by sex.

Chronic diseases n (%)	Total 25,951 (100)	95% CI	Female sex 12,961 (50.20)	Male sex 12,858 (49.80)	p
Respiratory disease	1,074 (4.14)	3.90-4.38	446 (3.44)	624 (4.85)	<0.001
Neurological disease	762 (2.94)	2.73-3.14	336 (2.59)	425 (3.31)	0.001
Digestive disease	592 (2.28)	2.10-2.46	324 (2.50)	267 (2.08)	0.023
Musculoskeletal disease	325 (1.25)	1.12-1.39	172 (1.33)	151 (1.17)	0.270
Heart disease	297 (1.14)	1.02-1.27	151 (1.17)	145 (1.13)	0.778
Autism spectrum disorder	75 (0.29)	0.22-0.35	12 (0.09)	63 (0.49)	<0.001
At least one chronic disease	2,452 (9.45)	9.09-9.80	1,123 (8.66)	1,325 (10.30)	<0.001

Table 3. Prevalence of chronic diseases present in the studied population of schoolchildren, segmented by school level.

Chronic diseases n (%)	Preschool 4,982 (19.20)	Primary 11,039 (42.54)	Secondary 7,453 (28.72)	Baccalaureate 2,132 (8.22)	Vocational education 345 (1.33)	p
Respiratory disease	194 (3.89)	493 (4.47)	295 (3.96)	92 (4.32)	0 (0.0)	0.001
Neurological disease	66 (1.32)	291 (2.64)	323 (4.33)	76 (3.56)	6 (1.74)	<0.001
Digestive disease	103 (2.07)	291 (2.64)	153 (2.05)	41 (1.92)	4 (1.16)	0.016
Musculoskeletal disease	23 (0.46)	139 (1.26)	115 (1.54)	47 (2.20)	1 (0.29)	<0.001
Heart disease	50 (1.00)	135 (1.22)	90 (1.21)	22 (1.03)	0 (0.0)	0.201
Autism spectrum disorder	19 (0.38)	29 (0.26)	24 (0.32)	3 (0.14)	0 (0.0)	0.325
At least one chronic illness	391 (7.85)	1,079 (9.77)	776 (10.41)	196 (9.19)	10 (2.90)	<0.001

Allergies and Food Intolerance

A total of 3,254 (12.54%) of students had at least one type of allergy, with a significantly higher prevalence in secondary students (n = 1,075, 14.42%), followed by baccalaureate (n = 306, 14.35%) and primary students (n = 1,429, 12.95%) ($p < .001$). Among these, 1,841 students (7.09%) had nonspecific allergies, 1,590 (6.13%) had a food allergy, and 247 (0.95%) had a drug allergy. The most frequently reported food allergies were to dried fruits (n = 490, 1.89%), peanuts (n = 286, 1.10%), eggs (n = 258, 0.99%), and milk (n = 220, 0.85%). A total of 729 (2.81%) students had some degree of food intolerance, which was more common in females (n = 393, 3.03%) vs. in males (n = 333, 2.59%) ($p = .032$) and significantly more common in secondary (n = 228, 3.06%) and primary students (n = 335, 3.03%) ($p < .001$). The allergies and intolerances of these schoolchildren overall and by sex and school level are shown in Table 4 and Table 5.

Table 4. Prevalence of chronic diseases present in the total population of schoolchildren studied and segmented by sex.

Allergies and intolerances n (%)	Total 25,951 (100)	95% CI	Female sex 12,961 (50.20)	Male sex 12,858 (49.80)	p
Nonspecific allergy	1,841 (7.09)	6.78-7.41	864 (6.67)	974 (7.58)	0.005
Food allergy	1,590 (6.13)	5.84-6.42	790 (6.10)	792 (6.16)	0.829
Dried fruits	490 (1.89)	1.72-2.05	213 (1.64)	275 (2.14)	0.003
Peanuts	286 (1.10)	0.98-1.23	122 (0.94)	164 (1.28)	0.010
Egg	258 (0.99)	0.87-1.11	109 (0.84)	144 (1.12)	0.023
Milk	220 (0.85)	0.74-0.96	107 (0.83)	111 (0.86)	0.740
Cereals	161 (0.62)	0.52-0.72	101 (0.78)	59 (0.46)	0.001
Fish	132 (0.51)	0.42-0.60	55 (0.42)	77 (0.60)	0.049
Crustaceans	102 (0.39)	0.32-0.47	44 (0.34)	58 (0.45)	0.153
Mollusks	63 (0.24)	0.18-0.30	29 (0.22)	34 (0.26)	0.508
Lupins	35 (0.13)	0.09-0.18	13 (0.10)	22 (0.17)	0.122
Sesame	28 (0.11)	0.07-0.15	14 (0.11)	14 (0.11)	0.983
Soybeans	22 (0.08)	0.05-0.12	7 (0.05)	15 (0.12)	0.085
Mustard	16 (0.06)	0.03-0.09	8 (0.06)	8 (0.06)	0.987
Celery	6 (0.02)	0.00-0.04	1 (0.01)	5 (0.04)	0.100
Sulfites	3 (0.01)	0.00-0.02	2 (0.02)	1 (0.01)	0.568
Drug allergy	247 (0.95)	0.83-1.07	128 (0.99)	117 (0.91)	0.520
At least one allergy	3,254 (12.54)	12.14-12.94	1,581 (12.20)	1,662 (12.93)	0.081
Food intolerance	729 (2.81)	2.61-3.01	393 (3.03)	333 (2.59)	0.032

Table 5. Prevalence of chronic diseases present in the studied population of schoolchildren, segmented by school level.

Allergies and intolerances n (%)	Preschool 4,982 (19.20)	Primary 11,039 (42.54)	Secondary 7,453 (28.72)	Baccalaureate 2,132 (8.22)	Vocational education 345 (1.33)	p
Nonspecific allergy	125 (2.51)	788 (7.14)	713 (9.57)	211 (9.90)	4 (1.16)	<0.001
Food allergy	307 (6.16)	723 (6.55)	443 (5.94)	115 (5.39)	2 (0.58)	<0.001
Dried fruits	81 (1.63)	246 (2.33)	142 (1.91)	21 (0.98)	0 (0.0)	<0.001
Peanuts	46 (0.92)	138 (1.25)	84 (1.13)	18 (0.84)	0 (0.0)	0.065
Egg	102 (2.05)	103 (0.93)	41 (0.55)	12 (0.56)	0 (0.0)	<0.001
Milk	68 (1.36)	92 (0.83)	45 (0.60)	15 (0.70)	0 (0.0)	<0.001
Cereals	18 (0.36)	84 (0.76)	48 (0.64)	11 (0.52)	0 (0.0)	0.021
Fish	29 (0.58)	49 (0.44)	42 (0.56)	11 (0.52)	1 (0.29)	0.696
Crustaceans	15 (0.30)	42 (0.38)	32 (0.43)	12 (0.56)	1 (0.29)	0.552
Mollusks	6 (0.12)	28 (0.25)	19 (0.25)	9 (0.42)	1 (0.29)	0.196
Lupins	6 (0.12)	17 (0.15)	11 (0.15)	1 (0.05)	0 (0.0)	0.707
Sesame	8 (0.16)	12 (0.11)	7 (0.09)	1 (0.05)	0 (0.0)	0.640
Soybeans	5 (0.10)	8 (0.07)	7 (0.09)	2 (0.09)	0 (0.0)	0.948
Mustard	2 (0.04)	5 (0.05)	8 (0.11)	1 (0.05)	0 (0.0)	0.453
Celery	2 (0.04)	2 (0.02)	2 (0.03)	0 (0.0)	0 (0.0)	0.851
Sulfites	0 (0.0)	1 (0.01)	1 (0.01)	1 (0.05)	0 (0.0)	0.557
Drug allergy	25 (0.50)	98 (0.89)	87 (1.17)	36 (1.69)	1 (0.29)	<0.001
At least one allergy	439 (8.81)	1,429 (12.95)	1,075 (14.42)	306 (14.35)	5 (1.45)	<0.001
Food intolerance	108 (2.17)	335 (3.03)	228 (3.06)	58 (2.72)	0 (0.0)	<0.001

DISCUSSION

Main findings

The findings of this study reveal a significant prevalence of chronic diseases, allergies (most commonly to food such as nuts, peanuts, eggs, and milk), and food intolerance among a large population of children in a network of educational centers with a school nurse. Males had a higher prevalence of chronic disorders, including respiratory, neurological, and digestive problems, while allergies affected both sexes similarly. Food intolerances, however, were more prevalent in females.

Sociodemographic characteristics of the schoolchildren

In the sample studied, the proportions of male and female students were nearly similar;

although the Spanish National Statistics Institute (2024a) reported that the proportion of males under 18 years of age was higher. These national data aligned with our distribution of students by education level, with primary education being the most represented level, followed by secondary education, preschool, and, to a lesser extent, high school. Our results reflect that, at the high school education level, the percentage of males was lower than that of females, which is consistent with literature indicating that the majority of adolescents who abandon their studies after the age of 16 years are males (Suoniemi et al., 2021). The distribution of education level according to student sex found in this study mirrors the national-level school data reported by the Spanish National Statistics Institute (2024b). In preschool, the proportion of males was slightly greater than that of females, with the proportion of males in school decreasing after the age of 16. This explains why the average age of the males in our study sample was slightly lower than that of the females.

Prevalence of chronic diseases in schoolchildren

The current literature generally focuses on specific pathologies, rather than analyzing them based on the systems affected. The prevalence data from this study fall within the range between 0.20% and 44% described in a systematic review (van der Lee et al., 2007), with differences in prevalence estimates likely due to variations in the definitions of pediatric chronic diseases and the populations studied. A previous study carried out in Madrid reported a prevalence of 15.70% for pediatric chronic diseases (Barrio Cortes et al., 2020), which is closer to the prevalence observed in our sample of schoolchildren.

Our results are consistent with existing literature reporting that boys are more likely to be diagnosed with chronic diseases compared to girls and that the prevalence of chronic diseases varies significantly with age (Barrio Cortes et al., 2020; Bell et al., 2020; Perrin et al., 2014). Another Spanish study also found that the majority of children with chronic diseases were aged between 6 and 16 years (Barrio Cortes et al., 2020), although some

studies reported that younger children were more commonly diagnosed, but agreeing that older children experienced them less frequently (Bell et al., 2020; Penela-Sánchez et al., 2020). Notably, the prevalence of chronic diseases among vocational education students was lower compared to students at other school levels, which may be due to these students avoiding visits to school nurses in favor of seeing their family doctor.

The most common chronic diseases in our sample of schoolchildren were respiratory conditions, consistent with studies that report asthma as one of the most common chronic conditions in children (Barrio Cortes et al., 2020; Perrin et al., 2014; Van Cleave et al., 2010). The prevalence of respiratory diseases in our population was 4.14%, close to the 4.60% prevalence of asthma reported by the Spanish National Statistics Institute (2024c). Although our study found a slightly lower prevalence of respiratory diseases compared to other studies on asthma (Barrio Cortes et al., 2020; González Martín, 2014; Nasir et al., 2018), our results align with previous reports indicating that males are more likely to be diagnosed with respiratory diseases than females (Bai et al., 2017; Spanish National Statistics Institute, 2024c; Ullah & Kaelber, 2021). The prevalence of respiratory diseases also varies with age, as described in previous studies, although the most affected age groups differ (Ullah & Kaelber, 2021).

Regarding neurological disorders, the literature indicates that their prevalence in children can vary significantly from 1% (Kumar et al., 2022) to close to 10% (Akodu et al., 2022; López & Förster, 2022), depending on the definitions and diagnostic criteria, study methodologies, and participants characteristics (López & Förster, 2022). The prevalence of neurological disorders in our sample was 2.94%, which is close to the 3.30% reported by Nasir et al. (2018). Our results align with findings that males are significantly more likely to experience these disorders than females (Akodu et al., 2022; Kumar et al., 2022) and that prevalence varies by age group (Kumar et al., 2022).

For digestive diseases, González Martín (2014) categorized them into types such as gastritis and gastroesophageal reflux (0.40%), Crohn's disease (0.20%) and duodenal ulcers (0.30%). In contrast, Barrio Cortes et al. (2020) evaluated only inflammatory bowel disease reporting a prevalence of 0.03% in children under 18. Nasir et al. (2018) reported a 7.50% prevalence of children experiencing gastrointestinal disease. All these prevalences differ considerably from the 2.28% prevalence observed in our study sample, but agree with the findings that females are more likely to experience gastrointestinal disorders (Scarpato et al., 2018).

Musculoskeletal disorders are often focused on pain rather than specific diseases. González Martín (2014) categorized these musculoskeletal disorders and reported prevalences for scoliosis or kyphoscoliosis (5.08% - 10.22%), kyphosis (0.19% - 0.93%), flat feet (1.12% - 3.68%), ligamentous laxity (0.44% - 5.69%), cavus foot (0.45% -1.16%) and dysmetria (0.21% - 1.16%). Barrio Cortes et al. (2020) evaluated only arthritis, reporting a prevalence of 0.50%. In contrast, our study revealed the prevalence of musculoskeletal disorders in children was 1.25%. A review of musculoskeletal disorders among children and adolescents suggested these disorders tend to increase with age, which is also reflected in our results (European Agency for Safety and Health at Work, 2021).

Regarding heart disorders, González Martín (2014) reported a prevalence between 0.58% and 2.27% while Barrio Cortes et al. (2020) evaluated only valvular disease with a prevalence of 0.10% in children under 18. In our sample, the prevalence of heart disorders was of 1.14%, falling between the values of the two aforementioned studies and coinciding with the prevalence of cardiovascular diseases below 2% reported by Nasir et al. (2018).

For autism spectrum disorder, our study found a prevalence of 0.29%, within the range of 0.07% reported by Barrio Cortes et al. (2020) in the Community of Madrid and 0.60% reported by Nasir et al. (2018) in the United States. This is consistent with previous studies (Perrin et al., 2014) showing that autism spectrum disorder is more common in boys. Despite

a previous study finding differences in the prevalence of autism by age group, our results did not reveal significant differences by educational level, although some studies report that girls may experience autism more frequently (Ullah & Kaelber, 2021).

The differences in gender and age prevalence rates, as well as discrepancies in chronic disease prevalence across studies, can be attributed to a combination of biological factors (e.g., hormonal differences and developmental stages), environmental and social factors (e.g., healthcare access and behavioral patterns), along with variations in diagnostic criteria, study methodologies, and sample demographics. For example, variations in the definitions and classifications of respiratory and neurological disorders impact prevalence rates, as noted in other studies (Kumar et al., 2022; López & Förster, 2022). Socioeconomic and geographic factors also influence disease prevalence by affecting healthcare access and environmental exposures (Kiewiet et al., 2023). Additionally, certain disorders, like musculoskeletal issues, increase with age, as noted in our study and others (European Agency for Safety and Health at Work, 2021).

Prevalence of allergies in schoolchildren

Few studies have estimated the prevalence of allergies in schoolchildren. Liu et al. (2020) reported that almost 60% of children in China were allergic to at least one allergen, a much higher prevalence than observed in our study, which did not include aeroallergens. Mao et al. (2020) observed a lower prevalence of allergies to aeroallergens (24.90%) compared to food allergies (38.81%). Other studies report a prevalence of allergies closer to our results. For example, a study in the United States reported that 12.60% of children had allergies (Nasir et al., 2018), making them the second most common chronic health problem in this population. These differences in allergy prevalence are widely acknowledged in the literature, as allergic sensitization profiles vary by region due to lifestyle, genetic factors, and environmental factors (Kiewiet et al., 2023). In Spain, the latest data from the Spanish

National Statistics Institute (2024d) show that 10.80% of children aged 0-14 years are diagnosed with chronic allergies, a percentage close to that reported in our sample.

Most studies on allergies in children focus on food allergies, which have a significant impact on children´s health and academic performance (Miller et al., 2016). A review published in 2018 estimated that food allergies could affect up to 10% of children, with food allergies being more common in children (Sicherer & Sampson, 2018). More specifically, another review found that food allergies range from 4% and 7% (Turnbull et al., 2015), fitting the prevalence of food allergies observed in our study. Differences in the prevalence of food allergies are attributed to variations in diagnostic methods (Nwaru et al., 2014; Spolidoro et al., 2023) and geographical factors (Urrea-Tobarra, 2023). In Spain, the estimated prevalence of food allergies is 7.40% (Zudaire, 2019); although, this may vary due to factors such as socioeconomic and ethnic characteristics, dietary practices, or access to healthcare (Sicherer & Sampson, 2018). Consistent with previous studies, our results show no significant differences in the prevalence of food allergies between sexes (Zablotsky et al., 2023; Liu et al., 2020; Mao et al., 2020). However, differences are found by age, with food allergies being more common from birth to primary education and decreasing as children grow older, likely because digestive enzymes mature over time (Liu et al., 2020; Mao et al., 2020). The highest burden of food allergies is typically associated with specific foods, such as milk, eggs, and nuts, followed by fish, shellfish, and wheat, as observed in our sample (Dierick et al., 2020; Loh & Tang, 2018; Sicherer & Sampson, 2018; Turnbull et al., 2015). Consistent with the literature, some food allergies evolve as children age, milk and egg allergies tend to resolve, whereas allergies to peanuts, fish, and shellfish tend to persist (Dierick et al., 2020; Kuźniar et al., 2024; Sicherer & Sampson, 2018; Turnbull et al., 2015).

Data on drug allergies are limited, and prevalence is often overestimated in the literature, as

diagnosis is usually based on patient or parent reports rather than diagnostic testing (Felix et al., 2024). For instance, one study based on parent reports found that 7% of children were allergic to medications; but only 1.5% had a clinical history suggestive of drug allergies, and just 0.05% had a drug allergy confirmed by testing (Capanoglu et al., 2022). The prevalence of drug allergies in our study sample (1%) was similar to the clinical history-based prevalence described in that study.

Prevalence variations stem from differences in allergen types studied, diagnostic methods, and regional factors. Studies that included both food and aeroallergens often report higher allergy rates (Liu et al., 2020; Mao et al., 2020). Regional dietary practices and diagnostic approaches also contribute to these discrepancies, as shown in our sample and in other research from Spain and the United States (Nasir et al., 2018; Zudaire, 2019). Furthermore, self-reported data may inflate prevalence estimates, particularly with drug allergies, where clinical confirmation is often lower than patient-reported cases (Capanoglu et al., 2022).

Food intolerances, which are non-immunological reactions to food, are estimated to affect about 20% of children based on patients reports, whereas the actual prevalence after diagnostic testing is closer to 2% (Turnbull et al., 2015), like what we observed. Additionally, our findings confirm that females are more prone to experiencing food intolerance than males.

Importance of the school nurse

School nurses are essential in the identification and management of chronic diseases, allergies, and intolerances in schools (Bergren, 2016). School nurses ensure continuous and trained surveillance of students with specific medical conditions, allowing regular monitoring of symptoms and proper medication administration. They also educate the school community and raise awareness of these disorders, providing guidance on recognition of emergency signs and prompt response to minimize risks (Endsley, 2017; Helleve et al.,

2022).

Beyond monitoring and education, school nurses act as an indispensable link between students, parents, and healthcare providers, coordinating medical care to implement individual treatment plans effectively. This coordination promotes an inclusive and safe school environment, where all students, regardless of their medical conditions, can fully engage in academic and extracurricular activities, supporting equitable development in the school setting (Gormley, 2019; Yonkaitis, 2018). Furthermore, data collection by school nurses is critical for assessing the outcomes of chronic diseases on various aspects of student life, including academic performance, attendance, and mental and behavioral health. By collecting and analyzing this data, school nurses can identify trends, evaluate the effectiveness of interventions, and ensure timely adjustments to care plans, thus improving overall student well-being (Stanislo, 2023). The use of documentation programs and electronic health records in schools by school nurses is essential for efficiently tracking students' health data, enabling the collection of valuable information on chronic conditions, allergies, and other health-related factors. These systems support data management, facilitate the analysis of student health trends and enable informed decision-making to improve health services in the school setting. They also enhance care quality by providing timely access to relevant data, improving communication among school staff, and ensuring continuity of care.

Limitations and strengths of the study

This study provides a detailed view of the prevalence of chronic diseases, allergies, and intolerances among a large sample of students from private and subsidized schools across various Spanish regions. While including public schools and a broader geographic range could increase national representativeness, the sample´s diversity supports extrapolation to the wider school-age population. Another limitation is that the data were collected from a

single software program, which may limit the generalizability of the findings to other systems. Currently, SNapp.care is the only software available for school nurses in Spain for managing student health and nursing activities and there are no other comparable programs specifically designed for this purpose at the moment. While this study focuses exclusively on data from centers within the SchoolNurses® network that use this program, similar documentation programs are used internationally to manage student health data. These systems share the common goal of supporting school health management and improving care for school-aged children, and other programs could yield different results or facilitate data collection and analysis in unique ways. Moreover, missing data from 83 students without age information slightly limited age-related analysis, though school level data provides age context. Further studies should prioritize comprehensive data collection to improve precision.

Additional limitations include the absence of a control group, which limits comparisons with unaffected populations and may influence prevalence estimates. Also, the cross-sectional design also prevents assessment of trends over time and limits our understanding of how the prevalence of chronic diseases may evolve in this population. Furthermore, confounding factors like household income, family medical history, environmental factors or lifestyle variables were not included, potentially impacting disease prevalence. Variations in socioeconomic status, geographic location healthcare access, diagnosis rates, and environmental exposures across regions may also limit the generalizability of findings. Furthermore, stigma, bullying, and social pressures related to chronic conditions, allergies, and intolerances may have led to underreporting by children, which could influence the accuracy of the prevalence rates observed. Despite these, the large and diverse sample size strengthens the study's applicability to the general school population.

This study fills a notable gap in the literature by examining the prevalence of chronic

diseases, allergies, and food intolerances in school children and adolescents. By grouping pathologies by systems and segmentation data by sex and age, the study provides valuable insights that can guide future research and public health policies. It also brings attention to the variability in the definitions and diagnostic criteria across studies, underscoring the importance of careful interpretation when comparing results studies.

Conclusions

This study highlights the significant burden of chronic conditions, particularly respiratory and neurological disorders, among schoolchildren. The high prevalence of allergies, especially food-related, underscores the urgent need for effective management strategies in school settings. These findings emphasize the critical role of school nurses in not only early detection and meticulous documentation of these conditions but also in coordinating care and education to ensure a safe, healthy-conscious environment.

To improve health outcomes, targeted policies should integrate school nursing services within the broader healthcare framework. This includes investing in training and resources for school nurses to better manage chronic diseases and allergies. Protocols for regular health screenings and early interventions can facilitate students' well-being. It is necessary that school nurses go beyond merely recording chronic conditions to actively collect, analyze, and integrate this data into practice. This systematic collection and analysis of health data by school nurses offers valuable insights into local epidemiological trends, guiding educational and health policies that foster interdisciplinary collaboration among educators, healthcare providers, and families.

Future research should focus on longitudinal studies exploring the impacts of chronic diseases and allergies on schoolchildren´s academic performance and quality of life. Addressing these policy needs and research directions will support a comprehensive, collaborative approach to childhood health. These data also reflect the rising prevalence of

chronic diseases and allergies in the school-age populations, remarking the need for educational and health policies that strengthen interdisciplinary collaboration and promote comprehensive health from an early age.

REFERENCES

Akodu O. S., Ogunlesi T. A., Adekanmbi A. F., Gbadebo F. A. (2022). Neurological diseases at the Pediatric Neurology Clinic in a semi-urban Nigerian tertiary hospital. *Sudanese Journal of Paediatrics*, *22*(1), 83–89. https://doi.org/10.24911/SJP.106-1588669565

Alonso Lebrero E., Alonso Lebrero J. L. (2011). Alumnado alérgico a alimentos y la escuela: problemas y soluciones. *Comedores escolares*, 3, pp. 5-8. https://www.aepnaa.org/recursos/aepnaa/pdf/socios/tren-salud.pdfBai G., Herten M. H., Landgraf J. M., Korfage I. J., Raat H. (2017). Childhood chronic conditions and health-related quality of life: Findings from a large population-based study. *PloS One*, *12*(6), e0178539. https://doi.org/10.1371/journal.pone.0178539

Barrio Cortes J., Suárez Fernández C., Bandeira de Oliveira M., Muñoz Lagos C., Beca Martínez M. T., Lozano Hernández C., del Cura González I. (2020). Chronic diseases in the paediatric population: Comorbidities and use of primary care services. *Anales de Pediatria*, *93*(3), 183–193. https://doi.org/10.1016/j.anpedi.2019.12.019

Bell J., Lingam R., Wakefield C. E., Fardell J. E., Zeltzer J., Hu N., Woolfenden S., Callander E., Marshall G. M., Nassar N. (2020). Prevalence, hospital admissions and costs of child chronic conditions: A population-based study. *Journal of Paediatrics and Child Health*, *56*(9), 1365–1370. https://doi.org/10.1111/jpc.14932

Bergren M. D. (2016). The Feasibility of Collecting School Nurse Data. *The Journal of School Nursing*, *32*(5), 337–346. https://doi.org/10.1177/1059840516649233

Capanoglu M., Erkocoglu M., Kaya A., Dibek Misirlioglu E., Ginis T., Toyran M., Civelek E., Kocabas C. N. (2022). Confirmation of drug allergy in a general pediatrics outpatient clinic. *Annals of Allergy, Asthma & Immunology :129*(6), 784–789. https://doi.org/10.1016/j.anai.2022.09.017

Centers for Disease Control and Prevention. (2017). Research brief: Chronic health conditions and academic achievement. https://www.cdc.gov/healthyschools/schoolhealthservices/pdf/chronic_conditions_achieve.pdf

Denny S., de Silva M., Fleming T., Clark T., Merry S., Ameratunga S., Milfont T., Farrant B., Fortune S. A. (2014). The prevalence of chronic health conditions impacting on daily functioning and the association with emotional well-being among a national sample of high school students. *The Journal of Adolescent Health*, *54*(4), 410–415. https://doi.org/10.1016/j.jadohealth.2013.09.010

Dierick B. J. H., van der Molen T., Flokstra-de Blok B. M. J., Muraro A., Postma M. J., Kocks J. W. H., van Boven J. F. M. (2020). Burden and socioeconomics of asthma, allergic rhinitis, atopic dermatitis and food allergy. *Expert Review of Pharmacoeconomics & Outcomes Research*, *20*(5), 437–453. https://doi.org/10.1080/14737167.2020.1819793

Dyer A. A., Gupta R. (2013). Epidemiology of childhood food allergy. *Pediatric Annals*, *42*(6), 91–95. https://doi.org/10.3928/00904481-20130522-08

Endsley P. (2017). School Nurse Workload. *The Journal of School Nursing*, *33*(1), 43–52. https://doi.org/10.1177/1059840516681423

European Agency for Safety and Health at Work. (2021). *Musculoskeletal disorders among*

children and young people: prevalence, risk factors, preventive measures A scoping review. Publications Office of the European Union. https://doi.org/10.2802/511243

Feldman L. Y., Merrill K., Golding M. A., Memauri T., Driedger S. M., Ross N. L., Protudjer J. L. P. (2022). Children's PERSPECTIVES ON FOOD ALLERGY IN SCHOols: A qualitative study. *The Journal of Vchool Nursing,* https://doi.org/10.1177/10598405221130694

Felix M. M. R., Kuschnir F. C., Boechat J. L., Castells M. (2024). Recent findings on drug hypersensitivity in children. *Frontiers in Allergy*, *5*, 1330517. https://doi.org/10.3389/falgy.2024.1330517

Gereige R. S., Gross T., Jastaniah E. (2022). Individual Medical Emergencies Occurring at School. *Pediatrics*, *150*(1). https://doi.org/10.1542/peds.2022-057987

Gómez Silva G., Carollo Motellón M., Abelairas Gómez C., Sánchez Santos L., García Doval F. M., Rodríguez Núñez A. (2020). [Schoolchildren with chronic diseases; what are teachers worried about?]. *Anales de pediatria*, *93*(6), 374–379. https://doi.org/10.1016/j.anpedi.2020.02.004

González Martín J. (2014). *[Epidemiology of chronic disease in physical education students from the Community of Madrid at secondary education and Baccalaureate]*. Doctoral thesis. Autonomous University of Madrid. https://repositorio.uam.es/bitstream/handle/10486/662760/gonzalez_martin_javier.pdf?sequence=1&isAllowed=y

Gormley J. M. (2019). School nurse advocacy for student health, safety, and school attendance: impact of an educational activity. *The Journal of School Nursing5*(6), 401–411. https://doi.org/10.1177/1059840518814294

Helleve A., Midthassel U. V., Federici R. A. (2022). Finding the balance between collaboration and autonomy among school nurses in interactions with schools. *The Journal of School Nursing*, *38*(2), 184–193. https://doi.org/10.1177/1059840520918924

Kiewiet M. B. G., Lupinek C., Vrtala S., Wieser S., Baar A., Kiss R., Kull I., Melén E., Wickman M., Porta D., Gori D., Gehring U., Aalberse R., Sunyer J., Standl M., Heinrich J., Waiblinger D., Wright J., Antó J. M., … Valenta R. (2023). A molecular sensitization map of European children reveals exposome- and climate-dependent sensitization profiles. *Allergy*, *78*(7), 2007–2018. https://doi.org/10.1111/all.15689

Kalra S., Kalra D. (2024). Bullying vulnerability among adolescents reporting food allergies: A nationwide US Study. *The Journal of School Nursing* https://doi.org/10.1177/10598405241277837

Kumar G., Sharma V., Kumar A. (2022). Clinical Profile of Pediatric Neurology Disorders: A study from a semi-urban medical college in northwestern india. *Cureus*, *14*(10), e30359. https://doi.org/10.7759/cureus.30359

Kuźniar J., Kozubek P., Gomułka K. (2024). Differences in the course, Diagnosis, and treatment of food allergies Depending on Age-Comparison of Children and Adults. *Nutrients*, *16*(9). https://doi.org/10.3390/nu16091317

Liu T., Lai S.-Y., Li W.-S., Jiang Y.-M. (2020). Prevalence of food allergen and aeroallergen sensitization among children in Sichuan province. *Medicine*, *99*(27), e21055. https://doi.org/10.1097/MD.0000000000021055

Loh W., Tang M. L. K. (2018). The epidemiology of food allergy in the global context. *International Journal of Environmental Research and Public Health*, *15*(9).

https://doi.org/10.3390/ijerph15092043

López I., Förster J. (2022). Neurodevelopmental Disorders: Where we are today and where we're going. *Revista Médica Clínica Las Condes*, *33*(4), 367–378. https://doi.org/10.1016/j.rmclc.2022.06.004

Mao S., Wu L., Shi W. (2020). Prevalence and distribution patterns of allergens among children with asthma and asthma-like symptoms in Shanghai, China. *Respiratory Research*, *21*(1), 57. https://doi.org/10.1186/s12931-020-1318-1

McEwen M., Wills E. M. (2023). Theoretical basis for nursing (Sixth edition). Wolters Kluwer.

Miller G. F., Coffield E., Leroy Z., Wallin R. (2016). Prevalence and costs of five chronic conditions in children. *The Journal of School Nursing : The Official Publication of the National Association of School Nurses*, *32*(5), 357–364. https://doi.org/10.1177/1059840516641190Nasir A., Nasir L., Tarrell A., Finken D., Lacroix A., Pinninti S., Pitner S., McCarthy M. (2018). Complexity in pediatric primary care. *Primary Health Care Research & Development*, *20*, e59. https://doi.org/10.1017/S146342361800035X

Nwaru B. I., Hickstein L., Panesar S. S., Muraro A., Werfel T., Cardona V., Dubois A. E. J., Halken S., Hoffmann-Sommergruber K., Poulsen L. K., Roberts G., Van Ree R., Vlieg-Boerstra B. J., Sheikh A. (2014). The epidemiology of food allergy in Europe: a systematic review and meta-analysis. *Allergy*, *69*(1), 62–75. https://doi.org/10.1111/all.12305

Penela-Sánchez D., Ricart S., Vidiella N., García-García J. J. (2020). [A study of paediatric patients with complex chronic conditions admitted to a paediatric department over a 12 month period]. *Anales de pediatria*. https://doi.org/10.1016/j.anpedi.2020.07.028

Perrin J. M., Anderson L. E., Van Cleave J. (2014). The rise in chronic conditions among

infants, children, and youth can be met with continued health system innovations. *Health Affairs (Project Hope)*, *33*(12), 2099–2105. https://doi.org/10.1377/hlthaff.2014.0832

Rona R. J., Keil T., Summers C., Gislason D., Zuidmeer L., Sodergren E., Sigurdardottir S. T., Lindner T., Goldhahn K., Dahlstrom J., McBride D., Madsen C. (2007). The prevalence of food allergy: a meta-analysis. *The Journal of Allergy and Clinical Immunology*, *120*(3), 638–646. https://doi.org/10.1016/j.jaci.2007.05.026

Scarpato E., Kolacek S., Jojkic-Pavkov D., Konjik V., Živković N., Roman E., Kostovski A., Zdraveska N., Altamimi E., Papadopoulou A., Karagiozoglou-Lampoudi T., Shamir R., Bar Lev M. R., Koleilat A., Mneimneh S., Bruzzese D., Leis R., Staiano A. (2018). Prevalence of functional gastrointestinal disorders in children and adolescents in the Mediterranean Region of Europe. *Clinical Gastroenterology and Hepatology : The Official Clinical Practice Journal of the American Gastroenterological Association*, *16*(6), 870–876. https://doi.org/10.1016/j.cgh.2017.11.005

School Nurses. (2022a). *School Nurses - School nurses in Spain*. https://schoolnurses.es/

Sicherer S. H., Sampson H. A. (2018). Food allergy: A review and update on epidemiology, pathogenesis, diagnosis, prevention, and management. *The Journal of Allergy and Clinical Immunology*, *141*(1), 41–58. https://doi.org/10.1016/j.jaci.2017.11.003

Spanish National Statistics Institute (2024a). *Population by age, sex and year*. https://www.ine.es/up/OGs95hR4i2P

Spanish National Statistics Institute (2024b). *Net enrolment rates by age*. https://www.ine.es/up/JD41sEtQi4

Spanish National Statistics Institute (2024c). *Asthma in the last 12 months in children by sex*

and age group. https://www.ine.es/up/eJyIg3tmi2

Spanish National Statistics Institute (2024d). *Chronic allergy in the last 12 months in children by sex and age group*. https://www.ine.es/up/eJyIg3tmi4

Spolidoro G. C. I., Amera Y. T., Ali M. M., Nyassi S., Lisik D., Ioannidou A., Rovner G., Khaleva E., Venter C., van Ree R., Worm M., Vlieg-Boerstra B., Sheikh A., Muraro A., Roberts G., Nwaru B. I. (2023). Frequency of food allergy in Europe: An updated systematic review and meta-analysis. *Allergy*, *78*(2), 351–368. https://doi.org/10.1111/all.15560

Stanislo K. J. (2023). Data Collection: Time to revisit the WHY, WHAT, and HOW. *NASN School Nurse*, 38(6), 310–315. https://doi.org/10.1177/1942602X231199932

Suoniemi S., Rantanen A., Koivisto A.-M., Joronen K. (2021). Self-reported school difficulties and the use of the school nurse services by adolescent students. *Children (Basel, Switzerland)*, *8*(8). https://doi.org/10.3390/children8080647

Tuck C. J., Biesiekierski J. R., Schmid-Grendelmeier P., Pohl D. (2019). Food 8intolerances. *Nutrients*, 11(7), 1684. https://doi.org/10.3390/nu11071684

Turnbull J. L., Adams H. N., Gorard D. A. (2015). Review article: The diagnosis and management of food allergy and food intolerances. *Alimentary Pharmacology & Therapeutics*, *41*(1), 3–25. https://doi.org/10.1111/apt.12984

Twichell S., Wang K., Robinson H., Acebal M., Sharma H. (2015). Food allergy knowledge and attitudes among school nurses in an urban public school district. *Children (Basel, Switzerland)*, *2*(3), 330–341. https://doi.org/10.3390/children2030330

Ullah F., Kaelber D. C. (2021). Using large aggregated de-identified electronic health record data to determine the prevalence of common chronic diseases in pediatric patients who visited

primary care clinics. *Academic Pediatrics*, *21*(6), 1084–1093. https://doi.org/10.1016/j.acap.2021.05.007

Urrea-Tobarra M. M., Blázquez Abellán G. (2023). Food allergies: review of legislation on allergen management and labelling. *Ars Pharmaceutica*, *64*(3). https://dx.doi.org/10.30827/ars.v64i3.27625

Van Cleave J., Gortmaker S. L., Perrin J. M. (2010). Dynamics of obesity and chronic health conditions among children and youth. *JAMA*, *303*(7), 623–630. https://doi.org/10.1001/jama.2010.104

van der Lee J. H., Mokkink L. B., Grootenhuis M. A., Heymans H. S., Offringa M. (2007). Definitions and measurement of chronic health conditions in childhood: a systematic review. *JAMA*, *297*(24), 2741–2751. https://doi.org/10.1001/jama.297.24.2741

Wang L. Y., Vernon-Smiley M., Gapinski M. A., Desisto M., Maughan E., Sheetz A. (2014). Cost-benefit study of school nursing services. *JAMA Pediatrics*, *168*(7), 642–648. https://doi.org/10.1001/jamapediatrics.2013.5441

White M. V, Goss D., Hollis K., Millar K., Silvia S., Siegel P. H., Bennett M. E., Wooddell M. J., Hogue S. L. (2016). Anaphylaxis triggers and treatments by grade level and staff training: Findings from the EPIPEN4SCHOOL pilot survey. *Pediatric Allergy, Immunology, and Pulmonology*, *29*(2), 80–85. https://doi.org/10.1089/ped.2015.0614

Yonkaitis C. F. (2018). Evidence-based practice and school nurse practice: A review of literature. *The Journal of School Nursing : The Official Publication of the National Association of School Nurses*, *34*(1), 60–67. https://doi.org/10.1177/1059840517728108

Zablotsky B., Black L. I., Akinbami L. J. (2023). Diagnosed allergic conditions in children

aged 0–17 Years: United States, 2021. NCHS Data Brief. https://www.cdc.gov/nchs/data/databriefs/db459.pdf

Zudaire L. Á. E. (2019). New developments in the diagnosis and prevention of food allergy. In AEPap (Ed.), *Congress of Pediatric Update 2019* (pp. 233–247). Madrid: Lúa Ediciones 3.0. https://www.aepap.org/sites/default/files/pags._233-248_novedades_en_diagnostico_y_prevencion._.pdf