Original Investigation Reports

Precarina: A new app to measure Cardiovascular Health Score in Children

Angela Sardella[1], Bárbara Wagmaister[1], Marina Vaccari[2], Miriam Tonietti[3], Patricia Palenque[3], Carolina Gvirtzman[4], Claudio Moros[1], Mariana Cazalas[1], María Sol Elorriaga[5], Gabriela Szulman[6], Claudio Grasso[7]

1 División Cardiología. Departamento de Medicina. Hospital de Niños Dr. Ricardo Gutiérrez, Ciudad Autónoma de Buenos Aires, Argentina. 2 Consultorio de Hipertensión Arterial. Departamento de Medicina. Hospital de Niños Dr. Ricardo Gutiérrez, Ciudad Autónoma de Buenos Aires, Argentina. 3 Sección Nutrición y Diabetes. Departamento de Medicina Hospital de Niños Dr. Ricardo Gutiérrez, Ciudad Autónoma de Buenos Aires, Argentina. 4 Laboratorio de Sueño, Neumología. Departamento de Medicina. Hospital de Niños Dr. Ricardo Gutiérrez, Ciudad Autónoma de Buenos Aires, Argentina. 5 Departamento de Pediátra. Hospital de Niños de San Isidro y Hospital Británico, Ciudad Autónoma de Buenos Aires, Argentina. 6 Unidad 13. Departamento de Medicina. Hospital de Niños Dr. Ricardo Gutiérrez, Ciudad Autónoma de Buenos Aires, Argentina. 7 Licenciado en Física. Elaboración y mantenimiento técnico de la app. Ciudad Autónoma de Buenos Aires, Argentina.

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ABSTRACT

Introduction: in 2010, the American Heart Association (AHA) defined cardiovascular health (CVH) as a lifelong health promotion strategy. Inspired by the AHA's Essential 8th publication and the My Life Check application launched in 2022, our goal was to create an application (app) tailored to pediatric outpatient care aligned with Argentina's CVH consensus and promote cardiovascular prevention in children in Argentina and Latin America.

Materials and Methods: the app analyzes eight CVH components, including healthy behaviors (diet, physical activity, tobacco exposure, sleep) and health factors (body mass index, blood lipids, blood glucose, and blood pressure). Users must accept terms and conditions to download the app, ensuring security standards for iPhone and Android. The estimated CVH score serves as a guide and highlights the importance of regular evaluations.

Results: results show individual metric scores from 0 to 100, allowing focused progress tracking. The overall score, an unweighted average, aids in comprehensive evaluation. The app facilitated the identification of cardiovascular risk factors in children, promoting early and personalized interventions.

Conclusions: this accessible and free app facilitates the long-term evaluation and monitoring of children's CVH. Its widespread use will contribute valuable data and tools to promote healthy behaviors in public health initiatives, improving childhood CVH and preventing future diseases in Argentina and Latin America.

INTRODUCTION

Cardiovascular diseases (CVDs) are still the main cause of mortality and morbidity throughout the world, representing 32% of all deaths.[1] In Argentina, nearly 30% of deaths are related to CVD.[2]

Figures are still more concerning if the load of the disease is considered in early ages, as many cardiovascular risk factors (CVRF) develop since childhood (obesity, type 2 diabetes, hypertension and dyslipidemias), resulting in CVD in adulthood.[3]

Health literacy considers that health behaviors sustained at an early age become standard, preventing vascular compromise and its consequences.

It is essential to promote healthy habits from the family environment, such as a balanced diet, regular practice of physical activity and appropriate rest. This also entails educating about the importance of controlling blood pressure, glucose and cholesterol levels, as well as explaining the need to carry out blood analyses for an initial screening.

Educational interventions are effective to improve health in children and teenagers, as a better communication in health may reduce the risk of CVD in the long run.[4]

Cardiovascular prevention in young adults is essential, as this group faces risks due to unhealthy behaviors (irresponsible alcohol consumption, smoking, sedentary lifestyle, poor diet habits and excessive weight gain). There is a considerable gap in the continuity of preventive strategies during adolescence into adulthood, increasing the risk of developing CVRFs. Closing this gap is essential, particularly promoting prevention practices since childhood and adolescence, which would enable transferring young adults with or without controlled risk factors, thus reducing their vulnerability to CVDs in the long run.[5,6]

Corresponding author's address: **Dra.Angela Sardella .**Avenida Virrey Vertíz, 1710. Piso 15. Departamento 28 - CABA – 1428 – Argentina. *e-mail*:

In August 2022, the American Heart Association (AHA) defined cardiovascular health as the promotion of health throughout life. Thus, they have released a free of charge application for adults, My Life CheckTM, based on the publication Life's Essential 8.[7,8]

The components of Life's Essential 8 are divided into healthy behaviors (diet, physical activity, exposition to tobacco, and sleep) and health factors (body mass index, cholesterol levels, sugar levels in blood and blood pressure). These eight components are essential to maintain and improve cardiovascular health (CVH).

Mobile health (mHealth) is an emerging field, using mobile devices and apps for health interventions. Among more than 100,000 health apps, near 29,000 are focused on weight loss, offering solutions for obesity in comparison with traditional methods. Although mHealth technologies have shown to be promising in different populations, evidence of their effectiveness to manage obesity and increase physical activity in children and teenagers is variable.[9]

There are different applications focused on CVH in adults, which monitor CVRFs with the aim of helping with self-management.[10] Personalized, educational and technology-based interventions are effective to prevent and manage CVRFs in young adults, in the promotion of healthy lifestyles, particularly in diet and exercise.

In children, the use of apps of physical activity and general wellbeing is promoted, which allows approaching risks before they manifest as diseases.[9] In contrast, apps for adults seek to control and reduce CVRFs that have already affected CVH, focusing on the management of preexisting CVDs.

This difference in approach is key: while in children the aim is preventing problems from emerging, in adults the focus is on managing conditions already affecting health.

This concept has inspired numerous projects with a common goal: promoting cardiovascular health throughout life, starting since childhood.

PRECARINA, an innovative digital tool to evaluate CVH in children, measures the score facilitating CVRF monitoring and promoting the adoption of healthy habits.

In a context of international efforts to approach cardiovascular health in a comprehensive manner, the PRECARINA app is presented, developed from the definition proposed by the AHA.

GOALS

The AHA article motivated several sectors of the Hospital de Niños Dr. Ricardo Gutiérrez (Buenos Aires - Argentina) to:

1. Design an app for children and teenagers, PRECARINA (PREvención CARdiovascular INfantil Argentina [Cardiovascular Prevention in Children in Argentina]) to estimate the cardiovascular health score, addressed to the health care and educational systems, and the community.[11]
2. Promoting Cardiovascular Prevention since childhood.

METHODOLOGY

PRECARINA estimates the CVH score according to the AHA guidelines, but adapted to the population of Argentina by local consensus. This estimation is made for individuals from 6 to 17 years, evaluating the established eight components.

Next, we present the components of Life's Essential 8 for children and teenagers. We suggest using it as a guide for patients and the community, promoting family and social health.

A. Healthy behaviors

1. Diet: healthy diet

Currently, the food environment presents a high offer and availability of food with high energy density and poor nutritional quality, with high contents of salt, sugar and fat, that have replaced the consumption of natural food that provides fibers, vitamins, minerals and nutrients beneficial for health. This modification in consumption patterns constitute an important risk for CVH.

The recommendations include daily consumption of: all food groups, 8 glasses of water, 5 portions of fruit and vegetables in a variety of types and colors, raw oil, dairy products (preferably with low fat content), lean meat, increase in the consumption of fish and including eggs, legumes, nuts and/or seeds. Furthermore, limiting the consumption of sugary drinks, salt, food high in sodium, fat and sugar; alcohol consumption. The guidelines that establish these recommendations for individuals and the general population are the GAPA (guías alimentarias para la población argentina [diet guidelines for the Argentinian population]), whose last issue is from 2018, and the DGA (Dietary Guidelines for Americans) 2020-2025.[8,9]

In terms of diet, the questionnaire on diet habits adjusts the variables to follow according to gender and age group. It is the result of an adjustment of the DGA 2020-2025 publication, evaluating the diet component through scores (Healthy Eating Index - HEI), measuring the cardiovascular health of the pediatric and adult population. The score allows to estimate cardiovascular health in the pediatric population by a method of inquiry. For this reason, to make a more accurate diagnosis, a more detailed evaluation should be conducted on the risks for CVH.

On the other hand, caloric and nutritional needs from the USDA Dietary Guidelines for Americans 2020-2025 were taken as reference, as they are appropriate for the age range and the gender of individuals.[12,13]

Finally, this task group acknowledges that there is no ideal method to evaluate all the food patterns, individually or in the population. But we emphasize that it is essential for professionals and health care systems to implement a periodical evaluation of dietary patterns, to monitor health in a wider way, and to intervene earlier and more effectively *(Tables 1 and 2).*

TABLE 1
Variables: domain, measurement method, quantifications and cardiovascular health score

DOMAIN	CV METRICS	MEASUREMENT METHOD	QUANTIFICATIONS AND CVH SCORE
HEALTHY BEHAVIORS	DIET	Daily ingest reported of a healthy diet pattern, adapted to the cultural patterns of the national population (DGA 2020-2025)	Children of 6 to 18 years Score (individual): **Points** — **Diet pattern** 100 (81-100) — Healthy diet pattern 80 (80-51) — Moderately healthy diet pattern 50 (50-26) — Diet pattern poor in quality of nutrients 25 (25-0) — Not healthy diet pattern 0 — Not healthy diet pattern See table of food portions by age group and gender *(TABLE 2)*
	PHYSICAL ACTIVITY	Validated questionnaire of self-report according to WHO metrics criteria: minutes of physical activity per week in ages 6 to 18	**Points** — **Minutes/week** 100 — ≥ 420 90 — 360-419 80 — 300-359 60 — 240-299 40 — 120-239 20 — 1-119 0 — 0
	EXPOSITION TO NICOTINE	Metrics: use of inhaled tobacco or inhaled NDS; or exposition to smoke of someone else's smoking. Self-report of use of cigarettes or devices with inhaled nicotine (NDS)	**Points** — **State** 100 — Never tried it 50 — Tried any product with nicotine more than 30 days ago 25 — Habitual use of inhaled NDS 0 — Habitual use of combustible tobacco within 30 days Note: subtract 20 points (unless the score is 0) for living with an active smoker in the house.
	HEALTHY SLEEP	Score in hours according to age	Age — 6 to < 13 years — 13-18 years Appropriate — 9-12 h — 8-10 h Inappropriate — <9 to >13 h — <8 to >10 h
HEALTHY FACTORS	BMI	Score according to percentile and Z score	NORMAL — < percentile 85 — (Z SCORE ≤1) OVERWEIGHT — > 85th percentile and < 95th percentile — (Z SCORE OF 1 AND 2) OBESITY — > 97th percentile — (Z SCORE ≥2<3) SEVERE OBESITY — > 99th percentile — (Z SCORE ≥3)
	MEASUREMENT OF LIPID LEVELS IN BLOOD	Metrics in mg/dl	ACCEPTABLE — LIMIT — HIGH Total choles — ≥170 — 170-199 — ≥200
	FASTING BLOOD GLUCOSE AND GLYCOSYLATED HEMOGLOBIN (HbA1c)	Métrica en mg/dl	NORMAL — PRE-DIABETES — DIABETES Fasting blood glucose — ≤ 100 mg/dl — ≥ 100 and < 126 mg/dl — ≥126 mg/dl HbA1c — ≤ 5.7% — ≥5.7% to <6.5% — ≥6.5%.
	BLOOD PRESSURE	SBP and DBP by auscultatory method (mmHg)	According to BP percentiles up to 16 years of age; older than 16 years by fixed values according to the current guidelines in Argentina. **LEVEL** 100 — NORMAL PRESSURE (less than 90th percentile or for teenagers older than 16 years systolic BP < 130 mmHg and diastolic <85 mmHg) 75 — HIGH PRESSURE OR PRE-HYPERTENSION (systolic and/or diastolic BP ≥P90 and <P95 for age, gender and height or for teenagers older than 16 years systolic BP between 130-139 mmHg and/or diastolic between 85-89 mmHg) 50 — STAGE 1 HYPERTENSION (systolic and/or diastolic BP ≥ P95 and <P95 + 12 mmHg for age, gender and height or for teenagers older than 16 years systolic BP between 140-159 mmHg and/or diastolic 90-99 mmHg) 25 — STAGE 2 HYPERTENSION (≥P95 + 12 mmHg for age, gender and height or for teenagers older than 16 years systolic BP 160-179 mmHg and/or diastolic 100-109 mmHg) 0 — For adolescents older than 16 years systolic BP ≥180 and/or diastolic ≥110 mmHg.

2. *Physical activity: more participation*

An Argentinian study offers a reliable evaluation on the levels of physical activity (minutes per week).[14] PRECARINA implements the questionnaire and improves it by adding an additional question on sedentary activities, as an extended time in front of screens *(Table 1)*.

3. *Exposition to nicotine: prevent it*

Smoking constitutes a preventable pandemic. Infants and small children are those most affected by the time of involuntary exposition in their homes.[15]

Besides cardiovascular consequences, prenatal exposition generates in descendants a decreased pulmonary function, repeated pulmonary infections, bronchial hyperresponsiveness, chronic obstructive pulmonary disease and cancer in adulthood.[16,17]

Exposition to secondhand smoke (SHS) in childhood is associated to left ventricular diastolic dysfunction, increase

TABLE 2

Combined table with portions of daily and weekly food, by age range for children: score

Food	Girls 1200 kcal (6- 8 years)	Girls 1600 kcal (9-13 years)	Girls 1800 kcal (14-18 years)	Boys 1400 kcal (5-8 years)	Boys 1800 kcal (9-13 years)	Boys 2200 kcal (14-18 years)	Score
Calories	1200 kcal	1600 kcal	1800 kcal	1400 kcal	1800 kcal	2200 kcal	
Green vegetables	1 serving per week	1 and 1/2 serving per week	1 and 1/2 serving per week	1 serving per week	1 and 1/2 serving per week	2 servings per week	2
Green vegetables	1/2 serving per week	1 serving per week	1 serving per week	1/2 serving per week	1 serving per week	1 serving per week	1
Green vegetables	< 1/2 serving per week	< 1 serving per week	< 1 serving per week	< 1/2 serving per week	< 1 serving per week	< 1 serving per week	0
Red/orange vegetables	3 servings per week or 1 small unit per day	4 servings per week	5 servings per week	3 servings per week or 1 small unit per day	5 1/2 servings per week or 1 medium unit per day or 3/4 serving per day	1/2 cooked serving per day or 3/4 raw serving per day or 6 medium units per week	2
Red/orange vegetables	1 serving per week	2 servings per week	3 servings per week	1 and 1/2 servings per week or 1 small unit every other day	3 servings per week or 1 small unit per day or 1/3 serving per day	1/4 cooked serving per day or 1/2 raw serving per day or 3 medium units per week	1
Red/orange vegetables	< 1 serving per week	< 2 servings per week	< 3 servings per week	< 1 and 1/2 serving per week or < 1 small unit every other day	< 3 servings per week or < 1 unit per day or < 1/3 serving per day	< 1/4 cooked serving per day or <1/2 raw serving per day or < 3 medium units per week	0
Legumes	1/2 serving per week or 2 small patties per week	1 serving per week or 1/2 serving + 1 patty per week	1 1/2 serving per week or 1 serving + 1 patty per week	1/2 serving per week or 1/4 serving + 1 patty per week	1 1/2 serving per week or 1/2 serving 3 times per week or 1 patty per day	2 servings per week or 1 serving + 2 patties per week	2
Legumes	1/4 serving per week or 1 small patty per week	1/2 serving per week or 1/4 serving + 1 patty per week	1 serving per week or 1/2 serving + 1 patty per week	1/4 serving per week or 1 small patty per week	1 serving per week or 1/2 serving per week or 1 patty 3 times per week	1 serving per week or 1/2 serving + 1 patty per week	1
Legumes	< 1/4 serving per week or < 1 small patty per week	< 1/2 serving per week o 1/4 serving + 1 patty per week	< 1 serving per week o 1/2 serving + 1 patty per week	< 1/4 serving per week o < 1 small patty per week	< 1 serving per week or < 1/2 serving per week o < 1 patty 3 times per week	< 1 serving per week or < 1/2 serving + 1 patty per week	0
Tubers (potato, sweet potato, cassava)	1/2 small unit per day or 1/4 serving per day or 3 small units per week	1/3 serving per day or up to 3 medium units per week	1/2 serving per day or up to 5 small units per week	1/2 small unit per day or 1/4 serving per day or 3 small units per week	1 small unit per day or 3 medium units per week or 1/3 serving per day	Up to 6 small units per week or 3 large units per week or 1/2 serving per day	2
Tubers (potato, sweet potato, cassava)	1 small unit per day o 1/2 serving per day or 3 medium units per week	1/2 serving or up to 5 small units per week	3/4 serving per day or small unit every day	1 small unit per day or 1/2 serving per day or 3 medium units per week	1 medium unit per day or 3 large units per week or 3/4 serving per day	Up to 9 units per week or 5 large units per week or 1 serving per day	1
Tubers (potato, sweet potato, cassava)	> 1 small unit per day or > 1/2 serving per day or > 3 medium units per week	> 1/2 serving o > 5 small units per week	> 3/4 serving per day or small unit every day	> 1 small unit per day or > 1/2 serving per day or > 3 medium units per week	> 1 medium unit per day or > 3 large units per week or > 3/4 serving per day	> 9 units per week or > 5 large units per week or > 1 serving per day	0
Other vegetables	3 medium units per week or 1/3 raw serving per day or 1/4 cooked serving per day	4 medium units per week or 1/2 raw serving per day or 1/4 cooked serving per day	5 medium units per week or 1/2 raw serving per day or 1/4 cooked serving per day	3 medium units per week or 1/3 raw serving or 1/4 cooked serving	5 medium units per week or 1/2 raw serving per day or 1/4 cooked serving per day	1 medium unit per day or 3/4 raw serving per day or 1/2 cooked serving per day	2
Other vegetables	1 medium unit per week or 1/4 raw serving per day or 1/4 cooked serving 4 times per week	2 medium units per week or 1/4 serving per day	2 1/2 medium units per week or 1/3 raw serving per day or 1/4 cooked serving	1 medium unit per week or 1/4 raw serving per day or 1/4 serving 4 times per week	2 1/2 medium units per week or 1/3 raw serving per day or 1/4 cooked serving	1 small unit per day or 1/2 raw serving per day or 1/4 cooked serving per day	1
Other vegetables	< 1 medium unit per week or < 1/4 raw serving per day or < 1/4 cooked serving 4 times per week	< 2 medium units per week or 1/4 serving per day	< 2 1/2 medium units per week or 1/3 raw serving per day or 1/4 cooked serving	< 1 medium unit per week or 1/4 raw serving per day or 1/4 serving 4 times per week	< 2 1/2 medium units per week or < 1/3 raw serving per day or < 1/4 cooked serving	< 1 small unit per day or 1/2 raw serving per day or 1/4 cooked serving per day	0

Food	Girls 1200 kcal (6- 8 years)	Girls 1600 kcal (9-13 years)	Girls 1800 kcal (14-18 years)	Boys 1400 kcal (5-8 years)	Boys 1800 kcal (9-13 years)	Boys 2200 kcal (14-18 years)	Score
Fruits	1 medium unit per day or 2 small units per day	1 1/2 large unit per day or 2 medium units per day	1 1/2 large unit per day or 2 medium units per day	2 medium units per day	1 1/2 large unit per day or 2 medium units per day or 3 small units	2 large units per day or 4 small units per day	2
Fruits	1 small unit per day	1 medium unit per day	1 medium unit per day	1 medium unit per day	1 medium unit per day or 2 small units	1 large unit per day or 2 small units per day	1
Fruits	< 1 small unit per day	< 1 small unit per day	< 1 medium unit per day	< 1 medium unit per day	< 1 medium unit per day or < 2 small units per day	< 1 large unit per day or 2 small units per day	0
Bread	1 slice of bread or 1 mini bread or 3 crackers	Up to 2 slices of bread per day or 2 mini bread units or 6 crackers	Up to 2 slices of bread per day or 2 mini bread units or 6 crackers	Up to 1 slice of bread per day or 1 mini bread per day	Up to 2 slices of bread per day or 2 mini bread units per day	3 slices per day or 2 mini bread units	2
Bread	2 slices of bread or 2 mini bread units or 6 crackers	3 slices of bread per day or 3 mini bread units or 9 crackers	3 slices of bread per day or 3 mini bread units or 9 crackers	2 slices per day or 2 mini bread units per day	3 slices of bread per day or 3 mini bread units per day	6 slices per day or 4 mini bread units or 2 small baguettes	1
Bread	> 2 slices of bread or > 2 mini bread units or > 6 crackers	> 3 slices of bread per day or > 3 mini bread units or > 9 crackers	> 3 slices of bread per day > 3 mini bread units or > 9 crackers	> 2 slices per day or > 2 mini bread units per day	> 3 slices of bread per day or > 3 mini bread units per day	> 6 slices per day or > 4 mini bread units or > 2 small baguettes	0
Pasta and whole wheat dough: pizza, savory pie, empanada, cannelloni, tortilla.	1/4 serving per day or 1 portion of dough per day	1/4 serving per day of whole wheat dough or 1 portion of dough	1/2 serving per day of dough or 2 portions of dough per day	1/4 serving per day of whole wheat dough or 1 portion of dough per day	1/4 serving per day of whole wheat dough or 1 portion of dough	1/2 serving per day of whole wheat dough or 1 and 1/2 portions of dough per day	2
Pasta and whole wheat dough: pizza, savory pie, empanada, cannelloni, tortilla.	1/2 serving per day or 2 portions of dough per day	1/2 serving per day or 2 portions of dough	3/4 serving per day or 2 portions of dough per day	1/2 serving per day or 2 portions of dough per day	1/2 serving per day or 2 portions of dough	1 serving per day or 3 portions of dough per day	1
Pasta and whole wheat dough: pizza, savory pie, empanada, cannelloni, tortilla.	> 1/2 serving per day or > 2 portions of dough per day	> 1/2 serving per day or 2 portions of dough	> 3/4 serving per day or > 2 portions per day	> 1/2 serving per day or > 2 portions per day	> 1/2 serving per day or > 2 portions per day	> 1 serving per day or 3 portions of dough per day	0
Refined doughs (non-whole wheat)	1/4 serving per day or 1 portion of dough per day	1/4 serving per day of whole wheat dough or 1 portion of dough	1/2 serving per day or 2 portions of dough per day	1/4 serving per day of whole wheat dough or 1 portion of dough per day	1/4 serving per day of whole wheat dough or 1 portion of dough	1/2 serving per day of whole wheat dough or 1 y 1/2 portions of dough per day	2
Refined doughs (non-whole wheat)	1/2 serving per day or 2 portions of dough	1/2 serving per day or 2 portions of dough	3/4 serving per day or 3 portions of dough per day	1/2 serving per day or 2 portions of dough per day	1/2 serving per day or 2 portions of dough	1 serving per day or 3 portions of dough per day	1
Refined doughs (non-whole wheat)	> 1/2 serving per day or > 2 portions of dough per day	> 1/2 serving per day or > 2 portions of dough per day	> 3/4 serving per day or > 3 portions of dough per day	> 1/2 serving per day or > 2 portions of dough per day	> 1/2 serving per day or > 2 portions per day	> 1 serving per day or 3 portions of dough per day	0
Dairy products (milk, yogurt) partially skimmed	3/4 mugs per day or 2 teacups per day	2 teacups	2 mugs per day	3/4 mugs per day or 2 teacups per day	2 mugs	2 mugs	2
Dairy products (milk, yogurt) partially skimmed	1/2 mug per day or 1 teacup per day	1 teacup per day	1 mug per day	1/2 mug or 1 teacup per day	1 mug	1 mug	1
Dairy products (milk, yogurt) partially skimmed	< 1/2 mug per day or < 1 teacup per day	< 1 teacup per day	< 1 mug per day	< 1/2 mug or < 1 teacup	> 1 mug	> 1 mug	0
Partly skimmed, spreadable or semi-soft cheese (port salut, mozzarella)	1 portion of the size of a matchbox or the size of 1/2 card or 2 spoons	1 portion of the size of a matchbox or the size of 1/2 card or 2 spoons per day	1 portion of the size of a matchbox or the size of 1/2 card or 2 spoons per day	1 portion of a matchbox or 1/2 card or 2 spoons	1 portion of a matchbox or 1/2 card or 2 spoons per day	1 portion of a matchbox or 1/2 card or 2 spoons	2

Food	Girls 1200 kcal (6- 8 years)	Girls 1600 kcal (9-13 years)	Girls 1800 kcal (14-18 years)	Boys 1400 kcal (5-8 years)	Boys 1800 kcal (9-13 years)	Boys 2200 kcal (14-18 years)	Score
Partly skimmed, spreadable or semi-soft cheese (port salut, mozzarella)	1/2 portion the size of a matchbox or 1 cube or 1 spoon	1 portion the size of a cube or 1 spoon per day	1 portion the size of a cube or 1 spoon per day	1 portion the size of a cube	1 portion the size of a cube or 1 spoon per day	1 portion the size of a cube or 1 spoon	1
Partly skimmed, spreadable or semi-soft cheese (port salut, mozzarella)	< 1/2 portion the size of a matchbox or < 1 cube or < 1 spoon	< 1 portion the size of a cube or < 1 spoon per day	< 1 portion the size of cube or < 1 spoon per day	< 1 portion the size of a cube	< 1 portion the size of a cube or < 1 spoon per day	< 1 portion the size of a cube or < 1 spoon	0
Read meat, poultry and eggs per day	1/2 medium steak per day or 1 y 1/2 egg per day or 1 medium steak	1 small portion with no waste per day or up to 2 units of egg per day or 1 portion the size of a thin steak + 1 egg per day	1 small portion with no waste per day or up to 2 units of egg or 1/2 small portion + 1 egg	1 small portion with no waste 5 times per week or 1/2 small portion + 1/2 egg per day	1 small portion with no waste per day or up to 2 units of egg per day or 1 portion the size of a thin steak + 1 egg per day	1 medium portion with no waste per day or up to 3 units of egg per day or 1 small portion + 2 eggs per days	2
Read meat, poultry and eggs per day	1 medium steak per day or up to 2 units of eggs per day or 1 portion the size of a thin steak + 1 egg per day	2 small portions with no waste per day or up to 4 units of eggs per day or 1 small portion + 2 units of eggs	2 small portions with no waste per day or up to 4 units of eggs per day or 1 small portion + 2 units of eggs	1 medium portion with no waste per day or 1 small portion + 1 units of egg per day	2 small portions with no waste per day or up to 4 units of eggs per day or 1 small portion + 2 units of eggs per day	2 small portions with no waste per day or up to 4 units of eggs or 1 medium portion + 2 units of eggs	1
Read meat, poultry and eggs per day	> 1 medium steak per day or > 2 units of eggs per day or > 1 portion the size of a thin steak + 1 egg per day	> 2 small portions with no waste per day or > 4 units of eggs per day or > 1 small portion + 2 units of eggs	> 2 small portions with no waste per day or > 4 units of eggs per day or > 1 small portion + 2 units of eggs	> 1 medium portion with no waste per day or 1 small portion + 1 unit of eggs per day	> 2 small portions with no waste per day or > 4 units of eggs per day or > 1 small portion + 2 units of eggs per day	> 2 small portions with no waste per day or up to 4 units of eggs per day or 1 medium portion + 2 units of eggs	0
Fish	1 medium portions per week or 1 can per week	2 medium portions or 2 cans per week	2 medium portions or 2 cans per week	2 small portions per week or 1 and 1/2 can per week	2 medium portions or 2 cans per week	2 large portions per week or 2 cans per week or 1/3 serving of canned fish per week	2
Fish	1 small portion per week or 1/2 can per week	1 medium portion or 1 can per week	1 medium portion or 1 can per week	1 small portion per week or 1 can per week	1 medium portion or 1 can per week	1 medium portion per week or 1 can per week or 1/4 serving per week	1
Fish	< 1 small portion per week or < 1/2 can per week	< 1 medium portion or 1 can per week	< 1 medium portion or 1 can per week	< 1 small portion per week or 1 can per week	< 1 medium portion or 1 can per week	< 1 medium portion per week or 1 can per week or 1/4 serving per week	0
Nuts and seeds	4 walnut halves or 8 almonds or 1 spoon of seeds or peanuts per day	8 walnut halves or 15 almonds or 2 spoons per day of seeds or peanuts	10 walnut halves or 20 almonds or 2 spoons per day of seeds or peanuts	6 walnut halves or 10 almonds or 1 spoon per day of seeds or peanuts	10 walnut halves or 20 almonds or 2 spoons per day of seeds or peanuts	10 walnut halves per day or 20 almonds per day or 2 spoons per day of seeds or peanuts	2
Nuts and seeds	2 walnut halves or 4 almonds or 1 teaspoon of seeds or peanuts per day	4 walnut halves or 8 almonds or 1 spoon per day of seeds or peanuts	5 walnut halves or 10 almonds or 1 spoon per day of seeds or peanuts	3 walnut halves or 5 almonds or 1/2 spoon per day of seeds or peanuts	5 walnut halves or 10 almonds or 1 spoon per day of seeds or peanuts	5 walnut halves per day or 10 almonds per day or 1 spoon per day of seeds or peanuts	1
Nuts and seeds	< 2 walnut halves or < 4 almonds or < 1 teaspoon of seeds or peanuts per day	< 4 walnut halves or < 8 almonds or < 1 spoon per day of seeds or peanuts	< 5 walnut halves or < 10 almonds or < 1 spoon per day of seeds or peanuts	< 3 walnut halves or 5 almonds or 1/2 spoon per day of seeds or peanuts	< 5 walnut halves or 10 almonds or 1 spoon per day of seeds or peanuts	< 5 walnut halves per day or 10 almonds per day or 1 spoon per day of seeds or peanuts	0
Oils	2 spoons per day	2 spoons per day	2 spoons per day	2 spoons per day	2 spoons per day	3 spoons per day	2
Oils	1 spoon per day	1 spoon per day	1 spoon per day	Spoon per day	1 spoon per day	1 spoon per day	1
Oils	< 1 spoon per day	< 1 spoon per day	< 1 spoon per day	< 1 spoon per day	< 1 spoon per day	< 1 spoon per day	0

in the size of the left atrium, dyslipidemia and thrombosis. These conditions may contribute to the development of atherosclerosis, CAD, heart failure, peripheral artery disease, dementia and stroke, particularly in middle-aged men.[16,17]

These effects highlight the significance of protecting children from SHS, consumption from an early age and during pregnancy, to prevent cardiovascular complications throughout their lives.[16,17]

The AHA recommends subtracting 20 points in children and adults exposed to SHS indoors, given its potential effects in the long term on cardiopulmonary health.[18]

The score-metrics are related to the following variables:

- Use of combustible smoke or inhaled nicotine-delivery system (NDS): electronic cigarettes or vaping devices.
- Use of NDS at any age (according to the doctor's judgement) *(Table 1).*

4. Healthy sleep

PRECARINA uses the age of patients to generate a score aligned with the last scientific consensus on the optimal durations of sleep according to age. This function ensures for the app to deliver personalized recommendations for the appropriate times of sleep according with the current scientific knowledge *(Table 1).*[15,16,17,18]

B. Health factors

1. Body mass index: healthy weight

Body mass index (BMI) or the relationship between weight and height is the universally applicable practical indicator, also noninvasive, to identify overweight and obesity. In children and teenagers, percentile tables are used to define overweight (>85th percentile and <95th percentile), obesity (> 95th percentile) and severe obesity (>99th percentile). PRECARINA trains an automatic learning model with data from the World Health Organization and the National Health Center to estimate the BMI percentile *(Table 1).*[19]

2. Lipid levels in blood-cholesterol: healthy levels

Childhood dyslipidemia is a significant concern, as it persists in adult age and is useful as a risk indicator for the development of atherosclerosis. An accurate evaluation of lipid profiles is essential for an effective management and prevention of CVDs. In obesity, there is an increase in triglycerides levels, low HDL cholesterol and mild increase in LDL cholesterol.[20]

Unlike what was suggested by the AHA, measurement of non-HDL cholesterol was not included, taking as reference only the value of total cholesterol. However, in the case of detecting a high value, it is necessary to measure all lipid fractions, particularly non-HDL, representing the atherogenic fraction of cholesterol.

For this reason, we highlight the importance of making an initial screening in primary care, supplementing it with a complete lipid profile if there are alterations in the basic tests or family history of dyslipidemias.

All lipid measurements provided by PRECARINA are presented in milligrams by deciliter (mg/dl) *(Table 1).*

3. Glucose in blood-diabetes: healthy levels

Fasting blood glucose and glycosylated hemoglobin measurement should be included in the initial screening to detect alterations that may lead to the development of diabetes. The highest the values, the worse the metabolic control.[21,22]

All glucose measurements provided by PRECARINA are presented in milligrams per deciliter (mg/dl). Glycosylated hemoglobin measurements are presented in percentages *(Table 1).*

4. Blood pressure: healthy levels

Blood pressure measurements in pediatrics according to the current guidelines in Argentina are considered as values recorded by appropriate technique and size cuffs (inflation bulb covering 2/3 of the arm's diameter and 2/3 of its length). The correct technique is with the patient resting and calm: three measurements should be made and they should be averaged, preferably with the auscultatory technique and aneroid measurement.

For an appropriate use of the app, in the case of having recordings above the 90th percentile, the values to be entered should be 3 averages made in different consultations, with 3 measurements made per consultation.

Metrics:

percentiles of systolic and diastolic pressure (mmHg) for age, gender and size up to 16 years. For an age of more than 16 years, tables with adult values are used.

Variables are based on interpretation guidelines and new reference tables of blood pressure for children and teenagers of the National Program of School Health (PROSANE), on the joint Consensus on cardiovascular prevention in childhood and adolescence of the Argentine Society of Cardiology and the Argentine Society of Pediatrics and on the joint consensus on Hypertension of the Argentine Society of Cardiology, the Argentine Federation of Cardiology and the Argentine Society of Hypertension.[23,24,25]

The scores for each variable are made following the opinion of the AHA experts in the article Life's Essential 8.

To simplify the tasks of physicians and reduce potential human error, PRECARINA adds tables of blood pressure directly in its interface, including tables integrated by ages that go from 6 to 17 years, for both genders.

Categories:

Normal, normal high, hypertension stage 1, hypertension stage 2, hypertension stage 3. The scores are adjusted in the case of receiving antihypertensive medication *(Table 1).*

The app estimates and defines by means of Artificial Intelligence trained according to age, gender and height.

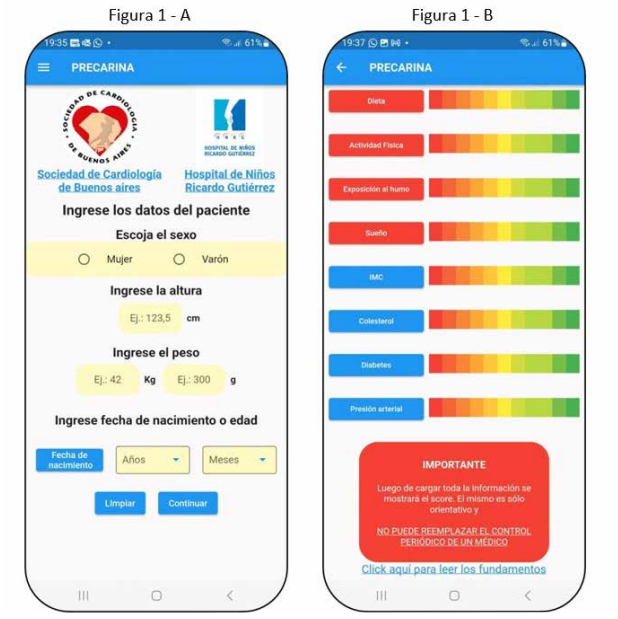

FIGURE 1.
1A: Load of gender, weight, height and age or date of birth.
1B: Score estimation for healthy factors and behaviors.

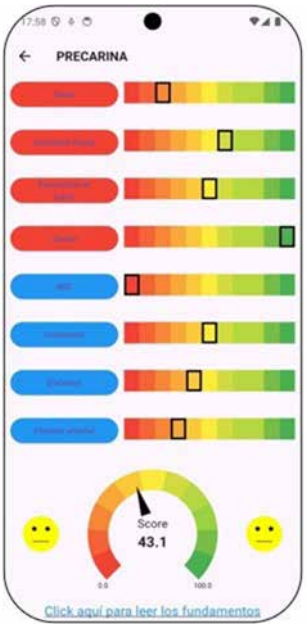

FIGURE 2.
CVH score (black rectangle) in the color scale. The addition of the score of the 8 items yields the final score value (tank). This example has a CVH score of 45.9 and is in yellow/red, so it is not good. The individual should improve their diet, sleep, BMI and blood pressure to reach the ideal score and avoid cardiovascular disease in the future.

RESULTS

PRECARINA can be downloaded for free from the Play Store (Android) and the App Store (IPhone). See link and QR download code at the end of the text.

Users should accept the terms and conditions. The app meets the security standards of iPhone/Android.

It is backed by the Hospital de Niños Dr. Ricardo Gutiérrez, Buenos Aires, Argentina, the Society of Cardiology of Buenos Aires and the Argentine Federation of Cardiology.

1. The initial screen is for entering the patient's data, used in several estimations.
a. Age: in years and months, or according to birthdate.
b. BMI: estimation and percentile by artificial intelligence, trained according to age, gender, and height.
c. Blood pressure: according to age, gender and height.
d. It has an outline with colors that correlate with the percentiles for each variable in terms of age and gender.
e. The CVH score is visualized according to a color metrics that range from 0 (red) to 100 (green). Each metrics maintains a score between 0 and 100, which allows focusing on the time to see a particular progress.
2. The application generates a new score that also ranges from 0 to 100 points, and it is an unweighted average of all metrics (health tank): the general score of CVH.

How to use the app?

1. First screen: enter gender, weight, height and age or date of birth. Anonymous data *(Figure 1A).*
2. Second screen: each item should be chosen and the questions should be answered *(Figure 1B).* A score will be provided, represented as a black rectangle in the color scale. The score addition of the 8 items yields the final score value *(Figure 2).*
3. The score ranges from 0 to 100. Green is the healthiest, close to a score of 100, and red represents a very unhealthy scenario, close to a score of 0.

Figure 2 shows an example of how to represent CVH with PRECARINA. The indicator in the inferior part reflects the general cardiovascular health score (general score), from 0 to 100, showing the highest scores in green at the right (a "tank" full of CVH). The general score is estimated as the unweighted average of the scores from the 8 metrics. The situation of an individual in each of the 8 metrics is presented in the upper part as the Individual Score, allowing to identify healthy behaviors and risk factors to focus on.

DISCUSSION

Cardiovascular prevention in childhood is crucial to approach the growing indices of CVD in the adult population. Adopting healthy habits since an early age not just reduces the risk of developing cardiovascular conditions, but also encourages integral wellbeing. It is essential to identify and modify risk factors in children and teenagers, as well as involving families and the community in prevention strategies.

These strategies should be translated to young adults as well. Training pediatricians and specialists on cardiovascular prevention is key to raise awareness in health care teams, teachers, parents and organizations on the importance of

this problem, including teenagers and pregnant adults, given its impact on the cardiovascular health of fetuses.

In this scenario, mobile applications and specific programs play a key role in the early modification of risk behaviors, particularly in childhood and adolescence, where interventions are essential.[4]

There are different projects focused on promoting CVH throughout life, aligned with the definition established by the AHA. The application My Life CheckTM is a tool for adults, free of charge, based on the concept of the Essential 8.[8]

The AHA also defines Life's Essential 8 for children and teenagers, promoting healthy habits from the home. This guide offers clear information about eight key elements, facilitating conversations on the health of children, and involving them in decisions that would favor personal and family wellbeing.

The aim of this project was developing a program addressed to children/adolescents and their environments with the aim of improving cardiovascular prevention, in agreement with international initiatives.

It is designed for pediatricians, specialists in adolescent medicine, teachers, parents and the community in general, both in Argentina and Latin America. It is based on the publication Life Essential 8, and on the application My Life Check, adapting these resources to a tool specific for the ambulatory care of children and teenagers, according to the local consensus on CVH.

The app analyzes the eight components, estimating the CVH score with a detailed view of progress, facilitating the identification of improvement areas and the implementation of personalized interventions.

Obtaining a CVH score since childhood is essential to prevent CVD and to facilitate the transition of teenagers with CVRFs to an adult cardiologist. It is crucial to ensure a proper transference, since the age group of young adults with cardiovascular risk often lacks an adequate diagnosis and follow-up. The absence of specialized care in this stage can lead to inefficient control of CVRFs, which increases the risk of developing severe CVDs in the future. This highlights the importance of a continuous approach to cardiovascular health throughout life.[26]

A prevention app for adults is based on behavior change theories and scientific evidence, increasing awareness on risks and motivating changes in lifestyle. User tests improve the experience by identifying errors and adding functions.[10]

This childhood cardiovascular prevention app encourages the active participation of users in the identification and correction of errors in their lifestyle, besides optimizing the platform to promote healthy habits that would prevent diseases and favor a better general health state.

Childhood CVH score is a guide for parents, carers and professionals, allowing a monitoring of progress by metrics from 0 to 100, and a general understandable evaluation.

The My Life CheckTM application is a tool for the evaluation of health and wellbeing, based on the concept of the Essential 8. It can be accessed for free, going to: heart.org/MyLifeCheck, through the platform Well-being Works BetterTM of the AHA *(https://www.heart.org/-/media/Healthy-Living-Files/Well-being-Works-Better/my_life_check_brochure.pdf)*.

Unlike My Life Check, which is focused on adults, this app is adapted to the specific needs of children and teenagers.

Although there are similarities between both applications, there are also noticeable differences that are analyzed below.

Similarities

- Both promote cardiovascular health and offer a comprehensive evaluation.
- They allow for progress monitoring with scores from 0 to 100.
- They are designed to be accessible and easy to use: My Life Check presents a language and design more addressed to adults. PRECARINA has a friendly, colorful and interactive interface to attract and maintain the attention of children and adolescents.

Differences

- Register: My Life Check requires opening a session: PRECARINA doesn't.
- Interface: My Life Check has 4 folders; PRECARINA 8.
- Metrics and evaluation of wellbeing: PRECARINA does not offer this function, but should consider individuals in a family and social environment, if there is discrimination or bullying due to ethnicity or physical condition, empowering to define themselves as healthy or not so, physically and psychologically.
- BMI estimation: different metrics. PRECARINA uses kilos, grams, meters and centimeters, and percentiles by age and gender.
- Score visualization: PRECARINA uses a color system, with emoticons; My Life Check only shows the final score.
- My Life Check offers links to information about CVD, advice on healthy lifestyle and access to support programs. PRECARINA provides guidance to parents or tutors to promote healthy habits, as well as educational resources adapted to childhood understanding and development.

In brief, PRECARINA adapts specifically to children and teenagers, focused on early prevention to improve CVH, while My Life Check is addressed to adults with and without CVH.

Although both apps share the goal of promoting CVH, they have differences in terms of functionality and focus, adapting to the specific needs of their respective users.

Initially, a plan of action was established for the next steps of the PRECARINA app, focusing on ensuring its dis-

semination and effective use. Later, a protocol will be implemented to guarantee anonymous data gathering and the necessary authorization to use them in research and statistical studies. This will enable obtaining valuable information to assess cardiovascular risk at population level.

Additionally, a final report will be generated, which users may save in an appropriate format. This report will include tables with curves that would show the evolution of the cardiovascular health score of each patient over time. This functionality will be useful so that individuals may visualize their progress and perform adjustments to their lifestyle so as to improve their CVH.

Currently, the app has not been validated yet. To carry out this validation, it is necessary to implement a series of stages, including dissemination and use of the app in the target population. Using PRECARINA will allow to detect and correct possible errors in the platform, improving its performance and results. Data gathering from users is a necessity to analyze the effectiveness of the app, and its impact on childhood CVH. This procedure is essential for validation, ensuring that the tool is reliable and useful in cardiovascular risk evaluation in the child and adolescent population.

Although wider studies are required to validate its efficacy, PRECARINA would fulfill its mission by identifying and correcting habits leading to CVD. Its score system enables users to improve their CVH by promoting positive changes in their lifestyle.

The tests on the effectiveness of mobile apps in childhood health are limited, but their accessibility is key in scenarios of low resources and low attendance to health care centers, offering personalized interventions for primordial and primary prevention of cardiovascular diseases.

CONCLUSIONS

The AHA defines CVH as a lifetime approach. PRECARINA estimates the score of cardiovascular health in agreement with international standards and Argentinian consensuses. It differentiates due to its focus on the pediatric and adolescent population, as well as due to its wide accessibility. The application promotes healthy habits and provides guidance, not substituting the professional medical evaluation.

The authors consider that its implementation will be key for cardiovascular prevention in children and teenagers, providing valuable tools and data for public health in Argentina and Latin America.

Link and QR download code of the 2.1.0 version (build 18) for Android and IOS

https://play.google.com/store/apps/details?id=ar.net.grasso.precarina

https://apps.apple.com/us/app/precarina/id6451156229

BIBLIOGRAPHY

1. World Health Organization. Enfermedades Cardiovasculares: datos y cifras **2021**. Disponible en https://www.who.int/es/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds). Acceso 1 de Septiembre de 2025.
2. Ministerio de Salud de la Nación Argentina. Estadísticas Vitales. Serie 5 Nº 66, Año **2022**. Disponible en https://www.argentina.gob.ar/sites/default/files/serie_5_nro_66_anuario_vitales_2022_3.pdf Acceso 1 de Septiembre de 2025.
3. Pan American Health Organization. Noncommunicable diseases in children, adolescents, and young adults. Disponible en https://www.paho.org/en/enlace/noncommunicable-diseases-children-adolescents-and-young-adults-visual-summary Acceso 1 de Septiembre de **2025**.
4. Climie R, Fuster V, Empana JP. Health Literacy and Primordial Prevention in Childhood—An Opportunity to Reduce the Burden of Cardiovascular Disease. JAMA Cardiol **2020**; 5: 1323 - 1324.
5. Tran D, Sojobi A. . Review of the Scientific Literature on Young Adults Related to Cardiovascular Disease Intervention. Asian Pac Isl Nurs J **2020**; 5: 35 - 46.

6. Gooding, H, Gidding S, Moran A, et al. Challenges and Opportunities for the Prevention and Treatment of Cardiovascular Disease Among Young Adults: Report from a National Heart, Lung, and Blood Institute Working Group. J Am Heart Assoc **2020**; 9: e016115
7. Lloyd-Jones DM, Allen NB, Anderson CAM, et al. Life's Essential 8: Updating and Enhancing the American Heart Association's Construct of Cardiovascular Health. Circulation **2022**; 146: e18 – e43.
8. American Heart Association. My Life Check. Disponible en https://www.heart.org/-/media/Healthy-Living-Files/Well-being-Works-Better/my_life_check_brochure.pdf Acceso 1 de Septiembre de **2025**.
9. Langarizadeh M, Sadeghi M, As'habi A, et al. Mobile apps for weight management in children and adolescents; An updated systematic review. Patient Educ Couns **2021**; 104; 2181 – 2188.
10. Buss VH, Varnfield M, Harris M. Mobile App for Prevention of Cardiovascular Disease and Type 2 Diabetes Mellitus: Development and Usability Study. JMIR Hum Factors **2022**; 9: e35065.
11. Sardella A, Wagmaister B, Vaccari M, et al. Noticias: APP PRECARINA: PREvención CARdiovascular INfantil Argentina. Rev Hosp Niños B Aires **2023**; 65: 259 - 264.
12. U.S. Department of Agriculture, U.S. Department of Health and Human Services. Dietary Guidelines for Americans 2020-2025. Disponible en https://www.dietaryguidelines.gov/sites/default/files/2020-12/Dietary_Guidelines_for_Americans_2020-2025.pdf Acceso 1 de Septiembre de **2025**.
13. Ministerio de Salud de la Nación Argentina. Manual para la aplicación de las Guías alimentarias para la población argentina. Disponible en https://www.argentina.gob.ar/alimentacion-saludable/comer-sano Acceso 1 de Septiembre de **2025**.
14. Laíño FA, Santa María CJ, Bazán NE, et al. Validation of a Physical Exercise Questionnaire in Children and Adolescents from Different Socioeconomic Strata. Apunts Educ Fis Deporte **2017**; 127: 35 - 43.
15. Raghuveer G, White DA, Hayman LL. Cardiovascular Consequences of Childhood Secondhand Tobacco Smoke Exposure: Prevailing Evidence, Burden, and Racial and Socioeconomic Disparities. Circulation **2016**; 134: e336 – e359.
16. Adachi H. Effects of Secondhand Smoke Exposure on Children's Future Health. J Atherosc Thromb **2022**; 30: 851 - 852.
17. Teramoto M, Iso H, Muraki I, et al. Secondhand Smoke Exposure in Childhood and Mortality from Coronary Heart Disease in Adulthood: the Japan Collaborative Cohort Study for Evaluation of Cancer Risk. J Atherosc Thromb **2022**; 30: 863 - 870.
18. Life's Essential 8. Disponible en https://www.heart.org/en/healthy-living/healthy-lifestyle/lifes-essential-8 Acceso 1 de Septiembre de **2025**.
19. Armeno M, Ferraro M, Figueroa Sobrero A, et al. Manual de Obesidad en Pediatría. Editorial Lugones; **2023**.
20. Araujo MB, Casavalle P, Tonietti M. Consenso sobre manejo de las dislipidemias en pediatría. Arch Argent Pediatr **2015**; 113: 177 - 186.
21. Mayer-Davis EJ, Kahkoska AR, Jefferies C, et al. ISPAD Clinical Practice Consensus Guidelines 2018: Definition, epidemiology, and classification of diabetes in children and adolescents. Pediatr Diabetes **2018**; 19(Suppl. 27): 7 - 19.
22. Annan F, Higgins LA, Jelleryd E, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Nutritional management in children and adolescents with diabetes. Pediatr Diabetes **2022**; 23: 1297 - 1321.
23. Bresso P, Ghezzi L, Iturzaeta A, et al. Interpretación y uso de las nuevas tablas de referencia de presión arterial para niños, niñas y adolescentes del Programa Nacional de Salud Escolar (PROSANE) Ministerio de Salud de la Nación Argentina. **2020**. Disponible en https://www.argentina.gob.ar/sites/default/files/bancos/2021-04/interpretacion-uso-nuevas-tablas-referencia-de-presion-arterial-prosane-2020.pdf Acceso 1 de Septiembre de 2025.
24. Cook C, Elizari A; Sociedad Argentina de Cardiología; Sociedad Argentina de Pediatría. Consenso de prevención cardiovascular en la infancia y la adolescencia. Arch Argent Pediatr **2019**; 117: S205 - S242.
25. Sociedad Argentina de Cardiología, Federación Argentina de Cardiología, Sociedad Argentina de Hipertensión Arterial. Consenso Argentino de Hipertensión Arterial. Rev Fed Arg Cardiol **2025**; 54 (suppl. 6): 5 – 64.
26. Mehta A, Dhindsa D, Sandesara P. Enhancing Preventive Cardiovascular Medicine Training During General Cardiology Fellowship. J Am Coll Cardiol **2019**; 74: 1637 - 1641.