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Seasonal influenza vaccination in childhood and adolescence. Consensus of the AEV, CAV-AEP and SEIP

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Abstract Influenza is an important public health problem that puts healthcare systems to the test each year with outbreaks that constitute a significant social and economic burden. The proportion of the pediatric population affected during the annual influenza season ranges between 30% and 40% worldwide, with 2–4 million severe cases in children under 18 years of age globally. Children and adolescents are also the main transmitters of the disease.

The consensus document presented here was developed jointly by three scientific societies: the Spanish Association of Vaccinology (AEV), the Spanish Association of Pediatrics, through its Advisory Committee on Vaccines and Immunizations (CAV-AEP), and the Spanish Society of

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Pediatric Infectious Diseases (SEIP). Routine influenza vaccination is recommended for children from 6 months of age and for adolescents up to 17 years of age (both included). Vaccination is also recommended for any individual that could transmit the virus to groups at increased risk of developing severe forms of disease and for household or close contacts of infants aged less than 6 months. Vaccination against influenza of all health care professionals as well as pregnant women (at any time during pregnancy) is especially important. For children aged 2 years or older and adolescents, unless contraindicated, vaccination with attenuated intranasal vaccine is preferred. Efforts should be made to improve influenza vaccination coverage in all the recommended groups, with particular emphasis on at-risk groups.

PALABRAS CLAVE
Vacuna de la gripe;
Niño;
Adolescente;
Embarazada;
Profesional sanitario;
AEV, CAV-AEP, SEIP

Vacunación antigripal en la infancia y la adolescencia. Consenso AEV, CAV-AEP y SEIP

Resumen La gripe constituye un importante problema de salud pública que pone cada año a prueba los sistemas sanitarios en forma de epidemias con elevadas implicaciones socioeconómicas. La proporción de población infantil afectada durante las mismas varía entre el 30 y 40%, produciéndose 2–4 millones de casos graves en <18 años en todo el mundo, siendo los niños y adolescentes, además, los principales transmisores de la enfermedad. La vacunación antigripal es la medida preventiva más efectiva, tanto individual como comunitaria.

El documento de consenso que se presenta tiene la autoría de tres sociedades científicas: la Asociación Española de Vacunología (AEV), la Asociación Española de Pediatría a través de su Comité Asesor de Vacunas e Inmunizaciones (CAV-AEP), y la Sociedad Española de Infectología Pediátrica (SEIP). Se recomienda en cada campaña la vacunación sistemática frente a la gripe en niños y adolescentes desde los 6 meses hasta los 17 años de edad incluidos. También se recomienda a personas que puedan transmitir el virus a grupos que tienen mayor riesgo de padecer formas graves de la enfermedad, y convivientes o entorno familiar de los menores de 6 meses. Es especialmente importante la vacunación antigripal de todos los profesionales de la salud y la vacunación de las gestantes en cualquier momento del embarazo. En niños a partir de los 2 años de edad y en adolescentes, salvo contraindicación, se recomienda preferentemente la vacuna atenuada intranasal. Se deben aunar esfuerzos para mejorar las coberturas de vacunación frente a la gripe en todos los grupos recomendados y, especialmente, en aquellas personas con condiciones de riesgo.

Introduction

Influenza is an important public health problem that poses a challenge the health care system every year.

At the global level, it affects 30%–40% of the pediatric population each season, with nearly one million severe cases in children younger than 5 years. In addition, children are the main transmitters of the disease.

Vaccination is the most effective preventive measure against influenza, as, in addition to conferring individual protection to the child or adolescent, it significantly contributes to the protection of the family and the community. The World Health Organization (WHO) and the Spanish Ministry of Health recommend routine vaccination of children aged 6–59 months. The CAV-AEP (Advisory Committee on Vaccines of the Asociación Española de Pediatría [Spanish Association of Pediatrics]) has extended the recommendation for routine vaccination to age 17 years.

Vaccination of influenza is prioritized in individuals who are at risk, including children, on account of their increased vulnerability and higher incidence of severe disease, as well as their household contacts. Due to the particular characteristics of the pediatric population, additional promotion measures may be needed to achieve an adequate vaccination coverage.

This consensus document describes the influenza vaccine composition recommended by the WHO for the 2025–2026 season in the northern hemisphere and the vaccines available in Spain for pediatric patients. It describes practical aspects concerning dosage, administration and storage, summarizes the current evidence on their effectiveness in children and adolescents, highlights strategies for achieving high vaccine uptakes and analyzes important aspects such as safety, contraindications and precautions that providers need to be aware of.

Table 1 Summary of the recommendations for vaccination against influenza for 2025–2026 season.

- All children and adolescents aged 6 months through 17 years (universal vaccination)
- Risk groups: individuals aged 6 months or older in specific situations or with underlying diseases associated with an increased risk of developing complications of influenza
- Household contacts aged 6 months or older of individuals at risk
- Household contacts aged 6 months or older of infants aged less than 6 months
- All health care professionals
- Pregnant woman, for their own protection and the protection of their future children, at any point of pregnancy
In children aged less than 2 years and adolescents through age 17 years, use of the intranasal attenuated vaccine is preferred

The intranasal live attenuated influenza vaccine is recommended for children and adolescents aged 2–17 years due to its greater acceptability, which contributes to improving vaccine uptake, and its greater effectiveness, particularly after the administration of only one dose. This vaccine has the ability to simulate natural infection and induce a comparable humoral and cellular response that begins in the respiratory mucosa. Table 1 summarizes the recommendations for the 2025–2026 season.

Epidemiology of influenza in the 2024–2025 season

Every year, there are one thousand million cases of seasonal influenza worldwide, including 3–5 million severe cases and 290 000–650 000 deaths.[1,2] The proportion of the pediatric population affected by the disease ranges between 30% and 40% depending on the year, with 2–4 million severe cases in children younger than 18 years and up to 35 000 deaths in children aged less than 5 years.[3] Recent data from the United States show an increase in mortality in the group aged 5–17 years compared to previous years,[4,5] while data from Australia shows an increase in admissions to the intensive care unit (ICU) in children aged 5–9 years.[6]

Every season, children under 15 are the group with the highest incidence of influenza. In Spain, data on influenza activity in the 2024–2025 season provided by the acute respiratory infection surveillance system (SIVIRA)[7] show that the incidence of influenza managed at the primary care (PC) level decreased after the introduction of routine vaccination in children aged 6–59 months, especially after the second campaign (2024–2025), becoming lower compared to the group aged 5–19 years.

The hospitalization rate associated with influenza varies according to age and is highest in the first months of life. In healthy children younger than 4 years, the hospitalization rate is similar to that of older adults aged 65–79 years.[7]

Due to the aforementioned reasons (incidence, hospitalization, ICU admissions) in addition to the role of children as transmitters of influenza in the community, we recommend extending routine vaccination against influenza to children aged up to 17 years.

Influenza vaccines for the 2025–2026 season

Every year, the WHO issues recommendations regarding the composition of the seasonal influenza vaccines aiming to match the circulating strains in each hemisphere.

Since the 2024–2025 season, the WHO has recommended the use of trivalent excluding the B/Yamagata lineage due to the lack of detection of viruses of this lineage since 2020. For the upcoming 2025–2026 season, it has introduced changes in the H3N2 strains recommended for inclusion compared to the previous season[8] (Table 2).

In Spain, seven vaccine formulations, all of them trivalent, will be distributed for the upcoming season, of which five (4 inactivated and 1 live attenuated) are authorized for use in children and adolescents (Table 3). One of the inactivated vaccines is obtained from cell cultures and the other three, in addition to the attenuated vaccine, are manufactured using fertilized chicken eggs.

Dosage and administration

Although the official schedule for vaccination against influenza in healthy children aged less than 9 years who are being vaccinated for the first time, in agreement with the summary of product characteristics, calls administration of two doses at least four weeks apart,[9] the Public Health Committee of the Interterritorial Council of the National Health System of Spain[10] recommends administration of a single dose to streamline vaccination logistics and improve vaccination coverage.

Two doses should only be administered to children in risk groups aged less than 9 years the first season they are vaccinated against influenza. If they have received one or more doses in a previous campaign, a single dose should be administered in the current campaign[11] (Table 4).

All inactivated vaccines can be administered from 6 months of age. The intranasal attenuated vaccine is authorized for use from 2 to 17 years of age. The dose for all ages is 0.5 mL for inactivated vaccines and 0.2 mL (0.1 mL in each nostril) for the intranasal attenuated vaccine.

Effectiveness of the influenza vaccine in the pediatric age group

The vaccine effectiveness (VE) of influenza vaccines in reducing confirmed influenza, influenza-associated hospital admission and preventing fatalities varies based on the characteristics of the population, the type of vaccine used, the viruses circulating in the season and the match with the viruses contained in the vaccines, among other factors.[12]

With respect to the VE in the pediatric population, it is generally higher compared to the adult population and ranges between 25.6% and 78.8%.[13] A systematic review found a VE for preventing hospitalization of 57.4% (95% CI, 49.4%–65.4%), with a higher effectiveness against H1N1 (74.0%; 95% CI, 54.8%–93.3%) compared to type B (50.8%; 95% CI, 41.7%–59.9%), and moderate effectiveness against

Table 2 Vaccine composition recommendations for the 2025–2026 season in the northern hemisphere (WHO).[27]

	Egg-based vaccines		Recombinant or cell culture-based vaccines
	Inactivated	Attenuated[a]	
Trivalent vaccines	- A H1N1: an A/Victoria/4897/2022 (H1N1)pdm09-like virus - A H3N2: A/Croatia/10136RV/2023 (H3N2)-like virus [New] - B/Austria/1359417/2021 (B/Victoria lineage)-like virus	- A H1N1: A/Norway/31694/2022 (H1N1)pdm09-like virus - A H3N2: A/Perth/722/2024 V1 (H3N2) [New] - B/Austria/1359417/2021 (B/Victoria lineage)-like virus	- A H1N1: A/Wisconsin/67/2022 (H1N1)pdm09-like virus - A H3N2: A/District of Columbia/27/2023 (H3N2)-like virus [New] - B/Austria/1359417/2021 (B/Victoria lineage)-like virus

Abbreviation: WHO, World Health Organization.
[a] In the attenuated vaccine, the H1N1 A/Norway 31694 and the H3N2 A/Perth/722 strains are similar to the H1N1 A/Victoria/4897 and H3N2 A/Croatia/10136RV strains included in the egg-based inactivated vaccines.

Table 3 Influenza vaccines available for individuals aged less than 18 years available in Spain for the 2025–2026 season.

Preparation (manufacturer)	Virus	Vaccine type	Age	Dose	Route
Flucelvax (Seqirus)	Trivalent (cell culture-based)	Inactivated	≥6 months	0.5 mL	IM
Fluarix (GSK)	Trivalent (egg-based)	Inactivated	≥6 months	0.5 mL	IM
Influvac (Viatris)	Trivalent (egg-based)	Inactivated	≥6 months	0.5 mL	IM/SC
Vaxigrip (Sanofi)	Trivalent (egg-based)	Inactivated	≥6 months	0.5 mL	IM/SC
Fluenz (Astra Zeneca)	Trivalent (egg-based)	Attenuated	2—17 years	0.2 mL (0.1 mL in each nostril)	Intranasal

Abbreviations: IM, intramuscular; SC, subcutaneous.

H3N2 (40.7%; 95% CI, 25.6%–55.8%). Vaccine effectiveness was higher in children aged less than 5 years (61.7%; 95% CI, 49.2%–74.1%) and 5–17 years (54.3%; 95% CI, 35.1%–73.6%).[14]

In the 2022–2023 season, the VE in Andalusia was 51% (95% CI, 48%–53%) for preventing infection and 69% (95% CI, 56%–79%) for preventing hospitalization due to influenza.[15]

In Spain, a case-control study with effectiveness data from the 2023—24 season showed an adjusted VE of 70% (95% CI, 51%–81% CI) for prevention of acute respiratory disease managed at the PC level and 77% (95% CI, 21%–93% CI) for prevention of hospitalization due to severe respiratory disease.[16]

Safety, contraindications and precautions for influenza vaccines

Influenza vaccines have a high safety profile with a favorable risk-benefit balance.

The most common adverse effects with inactivated vaccines are local reactions (redness, tenderness). Systemic adverse events include fever, myalgia and fatigue, with a frequency ranging from 5% to 20%. Usually, these effects are mild and do not require medical attention.[17]

With the attenuated vaccine, the most common adverse reactions are nasal congestion and fever. In a prospective observational study,[18] the most frequently observed adverse events were lower respiratory tract infection and wheezing, although there was not an associated increase in the incidence of hospitalization due to these events compared to the unvaccinated.

A history of anaphylactic reaction to any vaccine component or to a previous dose of influenza vaccine is considered an absolute contraindication for the influenza vaccine. The recommendations for influenza vaccination in individuals with egg allergies are discussed in a separate section of this document.

The attenuated influenza vaccine is also contraindicated in:

- Immunocompromised individuals, with the exception of children with stable HIV infection with adequate immune function and receiving antiretroviral therapy.
- According to the summary of product characteristics, it would be contraindicated in individuals with egg allergy,

Table 4 Recommended dosage of vaccines against seasonal influenza for the 2025–2026 season based on age, risk factors and previous history of vaccination against influenza.

Vaccine	Age	Number of doses based on patient category	Volume per dose
Inactivated vaccine	6 months to 8 years	General population: one dose each season, independently of history of vaccination against influenza in previous seasons Risk groups: 2 doses at least 4 weeks apart in the first season vaccination is administered. In adherence with Ministry recommendations, if any doses have been received in prior campaigns, one dose should be administered instead of two.	0.5 mL for any age
	≥9 years	One dose per season, independently of history of vaccination against influenza in previous seasons and risk conditions	0.5 mL for any age
Attenuated vaccine	24 months to 8 years	General population: one dose each season, independently of history of vaccination against influenza in previous seasons Risk groups (without contraindication for attenuated vaccines): 2 doses at least 4 weeks apart in the first season vaccination is administered. In adherence with Ministry recommendations, if any doses have been received in prior campaigns, one dose should be administered instead of two.	0.1 mL in each nostril
	≥9 years	One dose per season, independently of history of vaccination against influenza in previous seasons and risk conditions	0.1 mL in each nostril

although both the CAV-AEP[11] and Spanish Ministry of Health,[10] as well as the Centers for Disease Control and Prevention (CDC),[19] allow its use with the precautions recommended for all other vaccines.

- Household contacts of severely immunocompromised individuals. If they receive this vaccine due to error, contact needs to be avoided for 1–2 weeks following vaccination.
- Children aged 2–17 years currently medicated with aspirin or any other treatment containing acetylsalicylic acid due to the association with Reye syndrome.
- Pregnant women, due to the lack of safety data.

The attenuated vaccine must be used with caution in individuals with severe asthma or active wheezing, as these conditions were not studied during clinical trials.[20] The CDC of the United States consider it contraindicated in children aged 2–4 years with asthma or who have had a wheezing episode in the past 12 months, while they recommend precaution in children aged 5 or more years with asthma on account of an increased risk of wheezing following vaccination.[21] However, a trial in children aged 5–17 years with asthma found no significant differences in the frequency of asthma-related symptoms or changes in lung function tests in the 14 days that followed vaccination with the use of the attenuated vaccine compared to the inactivated vaccine.[22]

There is no evidence in children that vaccination against influenza is a risk factor for Guillain-Barré syndrome (GBS). In addition, it is estimated that the risk of developing GBS after an influenza infection is greater than the risk associated with vaccination.[23,24] As a precaution, administration of additional doses is discouraged in healthy children who developed GBS within 6 weeks of receiving the influenza vaccine, although vaccination in subsequent seasons should still be considered in children with underlying diseases, in whom its benefits exceed the hypothetical risk.[25,26]

Caution must be exerted in children who developed immune thrombocytopaenic purpura in the week following receipt of the inactivated influenza vaccine. Given the risk of recurrence, the appropriateness of vaccination should be determined on a case-by-case basis.[25]

The American Academy of Pediatrics (AAP),[27] the CDC, the CAV-AEP and the Spanish Ministry of Health all consider that influenza vaccines can be co-administered with other vaccines in the child and adolescent immunization schedule. The intranasal vaccine can be administered with other parenteral or oral attenuated vaccines on the same day or as apart as desired.

Recommendations for vaccination

In adherence with the recommendations made by the WHO in 2012,[28] the CAV-AEP (since 2021) and the Public Health Committee (since 2022) in Spain recommend routine vaccination of children aged 6–59 months.[29]

It is well known that childhood vaccination has a significant impact on the transmission of influenza viruses and in reducing the incidence of influenza and its complications. In consequence, some countries extend vaccination beyond 5 years of age, such as the United Kingdom (up to 17 years),

Table 5 Recommendations for vaccination against influenza in the pediatric population for the 2025–2026 influenza season.

1. Vaccination of all children aged 6 months through 17 years[a] (universal recommendation)	
2. Children aged more than 6 months and adolescents at risk of complicated influenza due to the following circumstances or underlying diseases:	
- Chronic respiratory disease (cystic fibrosis, bronchopulmonary dysplasia, bronchiectasis, asthma and bronchial hyperresponsiveness, respiratory sequelae of severe COVID-19, ciliary dyskinesia, etc)	- Oncological disease
- Severe cardiovascular disease, including isolated systolic hypertension	- Rheumatic disease
- Chronic metabolic disease (eg, diabetes mellitus, inborn errors of metabolism, etc)	- Chronic neuromuscular disease and moderate or severe encephalopathy. Respiratory compromise and secretion management (tracheostomy, mechanical ventilation). Severe COVID-19 sequelae
- Chronic renal or hepatic disease	- Cochlear implant or awaiting implantation of one
- Chronic inflammatory bowel disease	- Cerebrospinal fluid fistula
- Celiac disease	- Moderate or severe undernutrition
- Immunodeficiency, congenital (excluding asymptomatic isolated IgA deficiency) or acquired (including HIV infection, treatment with sustained high-dose systemic corticosteroids, immunosuppressive drugs, eculizumab o ravulizumab, transplant recipients)	- Morbid obesity (BMI $\geq$ 3 standard deviations above the mean)
- Functional or anatomical asplenia	- Down syndrome and other genetic disorders associated with risk factors
- Moderate to severe hematological disease (eg, clinically significant anemia or haemoglobinopathy requiring blood products or transfusions, hemophilia and chronic bleeding disorders etc)	- Ongoing treatment with ASA - Institutionalized children or adolescents or children who are wards of the state - Pregnant women (at any time of pregnancy, during the influenza season)
3. Individuals that could transmit influenza to individuals in risk groups:	
- Household contacts and caregivers of individuals at risk[b]	
- Household contacts of infants aged less than 6 months	

Abbreviations: ASA, acetylsalicylic acid and derivatives; BMI, body mass index; HIV, human immunodeficiency virus.
[a] Aged less than 18 years.
[b] Special emphasis should be placed on vaccination against influenza of health care professionals in contact with patients, including pharmacy staff.

as it is a cost-effective measure[30] with a direct and indirect impact in terms of a reduction in the number of primary care and emergency department visits and hospitalization of children and adolescents and protection of unvaccinated adults.[31]

For all the above reasons, this consensus statement recommends extending vaccination through age 17 years, emphasizing the importance of vaccination in people with risk conditions and their household contacts. Extended vaccination would help increase vaccination coverage in this group.

Table 5 presents the recommendations for vaccination against influenza.

Vaccination in special situations

Individuals with egg allergies

The rate of anaphylaxis for seasonal flu vaccines has been estimated at 1.35 cases per million doses (95% CI, 0.65–2.47), and the reaction is usually related to components other than ovalbumin, since the amount of this protein contained in influenza vaccines ($\leq$1 μg/mL)[32] is considered completely safe in individuals with egg allergy. Acting based on previous clinical manifestations is recommended[11]:

- Individuals with mild reactions to egg, such as urticaria, can be vaccinated against influenza with any of the available vaccines.
- Individuals who have developed serious reactions after egg consumption, such as angioedema, respiratory distress or symptoms requiring adrenaline, may be vaccinated with any of the available vaccines but should be vaccinated in facilities, not necessarily hospitals, with adequately trained staff and with the experience and resources to manage potential serious reactions, and need to remain in observation for 30—60 min after receiving the vaccine
- A severe allergic reaction to the influenza vaccine, independently of the component that causes the reaction, is an absolute contraindication for receiving any future doses of vaccine.

Prior to vaccination of infants or young children, it is not necessary to ask whether they have already eaten eggs or

to inquire about a possible egg allergy, given the limited clinical significance of this factor, as it could potentially lead to vaccine refusal.[27]

In those autonomous community where it is available, the cell-based vaccine is the vaccine of choice for individuals with a history of severe allergic reaction to eggs.

Immunocompromised individuals or individuals with chronic diseases

Vaccination against influenza in individuals who are immunocompromised or have chronic diseases is indicated yearly from age 6 months, as the morbidity and mortality are higher in these individuals when they have the flu compared to their healthy counterparts. A study conducted in Spain showed that up to 45% of children with influenza-associated hospitalizations had comorbidities associated with an increased risk, yet only 26% had been vaccinated.[33] Vaccination of household and other close contacts of these patients, including health care professionals, is crucial.

Vaccination against seasonal flu during pregnancy

Pregnant women are at increased risk of severe disease, complications and hospitalization due to influenza, and influenza is associated with an increase in fetal death, preterm birth, low birth weight or congenital defects,[34] which is why since 2012 the WHO has recommended that pregnant woman be treated as a high-priority group.[28] The goal of vaccination is to protect the pregnant woman as well as the fetus and, later on, the infant in the first months of life. There is ample evidence of the safety of vaccination against influenza at any time of pregnancy.[35]

According to the SIVAMIN (the vaccination records system of the Spanish Ministry of Health), vaccination coverage in pregnant women in Spain has been increasing progressively. In the 2024–2025 season, the average coverage nationwide was 60.9%, ranging between 26.6% and 83.8 in the different autonomous communities. The development of a multidisciplinary strategy to train and involve all health care professionals in informing pregnant women about the impact of influenza and the importance of vaccination against it should be made a priority.[36]

The VE is estimated at 50.4% for pregnant women and 48.8% for infants up to age 6 months, in whom there is evidence of a 63% reduction in the incidence of influenza and a 45%–91.5% reduction in influenza-associated hospitalizations.[37]

Key aspects in pediatric influenza vaccination

In addition to the recommendation for routine vaccination against influenza in children and adolescents, it is essential to implement high-impact strategies to increase vaccination coverage, as some autonomous communities are already doing:

- Training of healthcare professionals: an essential measure, as they are responsible for providing information appropriately. It is the responsibility of both health care professionals and health care authorities and scientific societies to establish appropriate channels for this training.
- Active recommendation by health care professionals is the most important factor contributing to the decision of parents to vaccinate their children.[38] There is evidence of an association between higher vaccination coverage and higher frequency of active recommendation of vaccination by health care providers.
- Informing the population: conventional promotion tools, such as posters, do not boost vaccination coverage. The dissemination of information through social media, digital platforms, conventional mass-media and in pharmacies can help reach parents, vulnerable groups or individuals with language barriers.
- Active engagement: as occurred with immunization against respiratory syncytial virus, active engagement and promotion can achieve substantial increases in coverage while also reaching vulnerable groups, such as patients at risk.
- Improving accessibility of vaccination: this is crucial since, as vaccination against influenza is delivered in seasonal campaigns, additional efforts must be made to ensure that all groups have access to it. Vaccination in schools, walk-in vaccination, weekend vaccination clinics and opening of primary care centers in the afternoons, which make vaccination accessible for families outside regular working hours, have been found to increase vaccination coverage.
- Increasing acceptability: the availability of an intranasal vaccine has improved coverage, especially in school vaccination campaigns. There is evidence that the attenuated vaccine is widely accepted by children, parents, and health care professionals.[38,39]
- Alignment of public health administrators and scientific societies: it is important for both citizens and professionals to perceive that there is agreement between the recommendations of health authorities and scientific societies, as this reinforces the overall confidence in vaccination.
- Communicating up-to-date information on the health outcomes of vaccination campaigns to professionals and citizens, strengthening confidence in vaccination and allowing corrective measures to be taken to increase the effectiveness and efficiency of the program.

Improving coverage in risk groups

Immunization of individuals at risk should not be neglected in the context of routine vaccination of the target pediatric age groups, even if universal vaccination increases coverage in at-risk groups.

Few data are available on the coverage of vaccination against influenza in risk groups, with reported figures ranging between 15% and 25%.[40] It is difficult to keep track of this population, as it is heterogeneous, fluctuates over time and is composed of individuals whose condition may change with treatment.

Further efforts are needed to correctly identify and keep track of patients at risk, due to either a health condition or a treatment, to avoid underestimating the target population and to enable adequate active promotion of vaccination.

It is key that all professionals become engaged in a coordinated effort. Community pharmacies play an important role as a trusted source of information and in identifying patients to be vaccinated, as do scientific societies through education and the diffusion of knowledge, and patient associations in disseminating information among their members.

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Appendix A. Supplementary data

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Declaration of competing interest

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