EU-JAV
EUROPEAN JOINT ACTION ON VACCINATION

LAYMAN REPORT

European Joint Action on Vaccination (EU-JAV)

Strengthening European cooperation to fight vaccine-preventable diseases

Inserm
La science pour la santé
From science to health

RÉPUBLIQUE FRANÇAISE
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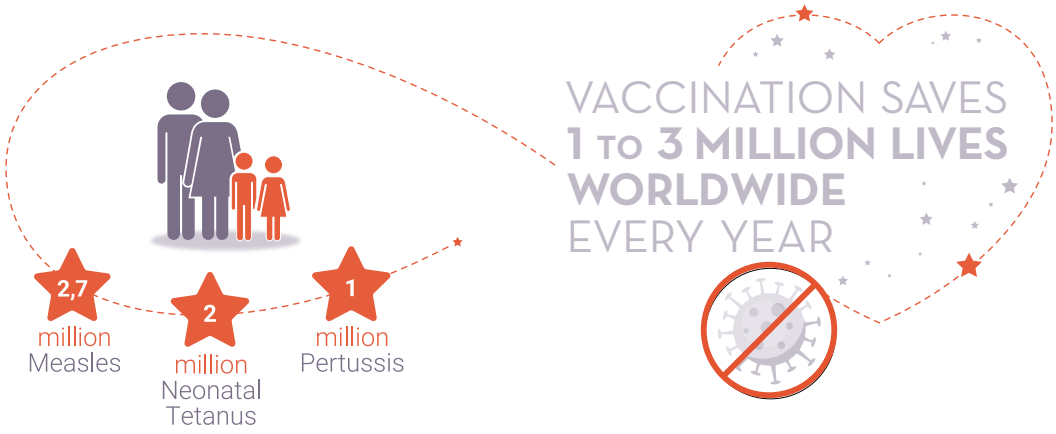
The Challenge and the Response

In the era of the United Nations Sustainable Development Goals on improving population health, the European Joint Action on Vaccination (EU-JAV) aims at spurring long-lasting European cooperation against vaccine-preventable diseases through its core mission of elaborating and sharing tools for stronger national responses to vaccination challenges.



Coordinated by the National Institute of Health and Medical Research, Inserm, FRANCE, with the support of the French Ministry for Health and Solidarities, the European Joint Action on Vaccination (EU-JAV) was launched in August 2018; it received a funding of EUR 5,800,000 (including 3,500,000 from the Health Programme 2014-2020 of the European Union), for a 3.5 year-period, and brought in close collaboration a wide range of stakeholders of 20 European countries (17 EU Member States and 3 non-EU countries - Serbia, Norway and Bosnia and Herzegovina), including the European Commission, health ministries, international policymakers and organisations, national and international agencies and institutions, universities, associations and federations, the civil society and manufacturers' representatives; each and every single one of which operate in the multiple fields of vaccination, vaccination policy and health services (ECDC, Vaccines Europe, EMA, EHMA, EPHA, EFPIA, WHO Europe and WHO International, just to name a few).

The unforeseeable event of the Covid-19 pandemic, followed by the discovery of new and of innovative technology vaccines and by the launch of an unprecedented immunisation campaign, have indeed rendered the relevancy of the work undertaken within the EU-JAV project in the most comprehensive way. The issues that Europe faced the past two years strongly resonate with the EU-JAV objectives, including joint vaccine procurement, joint research funding, cross-border vaccination, open access to vaccine coverage data, or the best ways to improve vaccine uptake.

WHO WE ARE

20 Partners

17 EU Member states

3 Non-EU Countries

WHAT WE DO

8

Work axes

1. COORDINATION
2. DISSEMINATION
3. EVALUATION
4. INTEGRATION IN NATIONAL POLICIES AND SUSTAINABILITY
5. IMMUNISATION INFORMATION SYSTEMS TO STRENGTHEN SURVEILLANCE OF VACCINE COVERAGE
6. VACCINE SUPPLY AND PREPAREDNESS
7. VACCINE RESEARCH AND DEVELOPMENT
8. INCREASING VACCINE ACCEPTANCE

OBJECTIVE

To build concrete tools to strengthen national responses to vaccination challenges in Europe and therefore ultimately improve population health through increased and stable vaccination coverage rates.

5,800,000€
Budget

3.5
Years duration
(01/08/2018 - 31/03/2022)

MAJOR TOPICS

1. Scientific evidence for national programs
2. Digital immunisation information systems
3. Concept of data warehouse on demand and supply
4. Vaccine research priority setting framework
5. Vaccine confidence

Setting the Goals for a European Joint Action on Vaccination

The ultimate focus of the EU-JAV has been to strengthen European Cooperation on Vaccination at a Europe scale, so as to improve the protection of the population against vaccine-preventable diseases. The strengthened cooperation referred to the development of a versatile, continuing and enduring systematic collaboration, which – while building on existing initiatives – would design, produce and promote concrete tools, practices and policies for the health authorities of Europe to incorporate and use universally.

These include efficient mechanisms for interoperability of digital vaccine-related database, robust methods of monitoring immunisation programmes, accurate forecasting of vaccine needs through a concept of repository of vaccine supply and demand data, priority-setting of vaccine research and development, an instrument to monitor vaccine confidence in social media, as well as a platform collecting and disseminating best practices and interventions to improve confidence in vaccination.

Separate teams were formed with the participation of experts from multiple institutions of the EU-JAV consortium and each team was assigned a distinct task.

Education, Communication, Cooperation and Sustainability

incorporate the outcomes of all WPs to implement best practices on vaccine policy in national policies and to build options for a sustainable mechanism of cooperation and communication between EU Members states and non-EU EU-JAV consortium member countries.

Vaccine Coverage and Reminder Systems

strengthen the interaction of immunisation Information Systems (IIS) in Europe in order to increase vaccine surveillance capabilities at the national and regional levels.

Vaccine Supply and Preparedness

define common basic principles for vaccine demand level of risks and develop a concept for how a data-warehouse for an EU-wide central repository for all consortium members (EU and non-EU) on vaccine supply and demand data can be designed.

Research Priority Identification and Funding Cooperation

define tools and methods for priority-setting and identify mechanisms to increase collaboration and cooperation in vaccine and vaccination research and research funding programmes among MS.

Vaccine Hesitancy and Uptake

develop a systematic overview and analysis of the current situation of activities related to vaccine hesitancy and uptake, including best practices and lessons learned in Member States and their regions

Disseminating Lessons Learnt

ensure the efficient dissemination of high-quality information on tools progress, events and final results of the European Joint Action on Vaccination (EU-JAV) to the widest possible audience, in order to increase acceptance of the findings and contribute in building confidence in the benefits of vaccination

Results and Recommendations for Further Actions

Two tools were elaborated and tested to monitor and address the pre-service and in-service needs of healthcare students and professionals: a "vaccine barometer", which allows measuring the skills and needs of participants regarding vaccination knowledge and practice, and a complete curriculum on vaccination, which addresses all the different relevant topics in the field.

We recommend that each country and each healthcare student/professional association make its own these tools and improve the impact of these crucial agents on vaccine uptake.

Two communication actions toward Youth were implemented: two competitions for the elaboration of posters and videos promoting HBV and HPV vaccination.

We recommend to have such wide actions launched regularly, at a European level, and based on what has been learned those first steps.

A platform to monitor and compare at national and subnational levels harmonised vaccine coverage was built upon a specific extension of the software R; with the example of measles-containing vaccines, it allows to identify immunisation gaps in spite of the complexity resulting from the difference of vaccines schedules between different countries.

We recommend implementing this platform with data from all the countries of the European area, to design actions at supranational level to prevent future epidemic bursts.

A study of the existing reminder systems was performed in 17 countries. Such systems are designed to ensure that as many individuals as possible will receive the recommended vaccines. All countries have reminder systems in place but the study highlighted the heterogeneity of these systems between European countries both the nature and the extension of the systems.

We recommend pursuing the extension and the generalization of such systems, and keeping them interoperable between countries.

A survey of the prerequisites, the operational implementation, and the perceived barriers and enablers for a conducting cross-borders vaccination campaigns was performed through questionnaires and workshops with 28 European countries; it paves the way to implement such international actions focused on a cross-border area.

We recommend to plan and to have rehearsals of such campaigns in anticipation of future needs.

A study of past vaccine shortages experiences was conducted; it allows identifying the vaccines involved and the causes (often multiple) of such shortages, and to emit recommendations to prevent these episodes.

We recommend to build of such experience to identify their prevention, and we indicate the key action points.

A study of financing mechanisms and of the feasibility of joint vaccine procurement (gathering EU member states) instead of national procurement was conducted, and led to a better understanding of how the ecosystem of vaccine procurement may evolve in the near future. In addition, a survey on the stockpiling of vaccines and the exchanges of vaccine stockpiles between EU member states has been conducted.

We recommend member states to strengthen their cooperation in this field and to ease exchanges when needed.

A method to consensually identify research priorities in vaccination has been elaborated, and was applied in 2020 and 2021 to set annual lists of the most relevant research topics that should receive attention and funding in the near future.

We recommend the funders to focus on these topics when awarding grants.

A survey regarding the mechanisms that may lead entities that provide research funds to collaborate and adopt joint funding to increase the efficiency of the research has been conducted

We recommend such synergy and co-reflections between funders to become the basic modus operandi.

A platform to gather as much as possible documents accounting for past experiences of EU member states in their efforts to address vaccine hesitancy has been launched; the many features on this platform allow to identify the best practices and the most efficient action in this field.

We recommend to analyse any project of future action to address vaccine hesitancy in the light of what has been learned from these past actions.

A platform that displays the monitoring of the vaccine confidence as expressed in the social media and the content of the online conversation regarding vaccine and vaccination has been elaborated.

We recommend the governments and stakeholders to be active online, and to address the signals of mistrust and concerns reflected in social media.

European Joint Action on Vaccination: Working on Sustainable Outcomes

Education, Communication, Cooperation and Sustainability

"Healthcare workers play a key role in working towards the goal of improved vaccination coverage rates. To support their efforts, they should be offered opportunities for continuous education and training on vaccination" (Council recommendation on strengthened cooperation against vaccine-preventable diseases). In light of these recommendations, the EU-JAV experts aimed at piloting selected actions to define the healthcare professionals' (HCP) perception regarding their qualifications in vaccination (deficiencies and training needs) and actions to improve and excel their education in vaccination, and to integrate these actions into national policies.

The Vaccine Training Barometer and the Curriculum on Vaccine and Vaccination represent valuable tools for monitoring and addressing the need for training of HCP involved in vaccine delivery and as such can be sustained and integrated into national vaccine policies.

In detail, the Vaccine Training Barometer allows to survey -online- the in-service HCPs need for training on vaccination: their education and knowledge on vaccination, their attitudes regarding the circulating misinformation / myths, as well as the questions the HCPs could not answer. It was pilot tested in Flanders (Belgium) -twice- and Spain -once; it clearly revealed HCPs need and determination for training on vaccination; most HCPs were willing to follow extra courses and only one third of HCPs felt confident to answer questions on vaccines. Moreover, **the overall notion that improved education on vaccination in the different (para)medical courses is needed to better support the role of future HCPs in vaccination programs** has been further advocated through a dedicated survey of 3500 health Students (medical as well as para-medical, members of student organisations represented in the Coalition for Vaccination), which assessed the attention given to vaccinology in HCPs education, their attitudes towards vaccination, and their confidence to answer questions about vaccination.

An optimal pre-service and in-service HCPs training in immunisation, suitable for all types of HCPs involved in the vaccination process, as well as future HCPs (health students following their standard education), was the outcome of these different surveys, shaping the all-inclusive curriculum on vaccines and vaccination. It incorporates all different topics divided in 8 different modules with their specific learning outcomes: 1. Rationale, context and history of immunisation, 2. Immunology/ immunopathology, 3. Key aspects vaccine safety, development, quality, 4. Vaccine preventable diseases, 5. immunisation policies and schedule, 6. Future perspectives, 7. Understanding, active listening and communication about vaccines and 8. Practical skills. When piloted in the Summer School on Vaccinology at the University of Antwerp, the curriculum was considered by the participants as very useful training and in line with their expectations.

Communication towards European young people on vaccines

The effective strategy of communication towards European young people on vaccines was designed and implemented by the Association of European Cancer Leagues (ECL) - subcontracted by the French Ministry for Solidarity and Health. It involved two communication pilot actions that aimed to raise awareness about vaccination among European youth, incorporating the input of the ECL Youth Ambassadors (YAs) for the European Code Against Cancer (ECAC). ECAC is a network of ambitious students and young professionals living in over 40 countries, interested in cancer prevention and health promotion.

The two Europe-wide youth competitions centred on vaccination sought compelling visual designs and short videos portraying the importance of vaccination with a focus on vaccination against Hepatitis B and Human papillomavirus (HPV). The one in 2019, targeted the school-aged children between 7-18 years old, and the next in 2021, the young people up to 25 years old.

Although, raising awareness about the importance of vaccination and its uptake to overcome vaccine hesitancy among young people has never been a walk in the park, these pilot actions showed that free, online competitions with prizes can provide a unique way to (i) spread pro-vaccine messages, (ii) engage and motivate young individuals, help them gain knowledge, to understand the importance of vaccination against myths and disinformation and to counter messages from anti-vaccine groups, (iii) enhance community building and strong following, (iv) create project awareness, and (v) lead to more input from the audience and stronger relationships in the long term.

Several difficulties in organising the Europe-wide competitions were reported, including the limited resources of the smaller in size civil society NGO (i.e. ECL), and the hard effort to get primary and secondary schools involved in the competition. Yet, these pilot actions, have established the point of reference for future Europe-wide competitions focusing on vaccination.

Vaccine coverage and reminder systems

Functional Specifications for pilot platform

The EU-JAV experts tasked to study Vaccine Coverage and Reminder Systems in Europe considered that the public sharing of harmonised vaccine coverage on a pilot platform should contribute to immunisation gaps identification, nationally and cross borders. Thus, the basic set of functional specifications for such a platform with a standardised approach was explored, with the example of measles-mumps-rubella (MMR) vaccination coverage. The developed platform - an English-(UK)-language-using web application – consisted of two parts: the publicly accessible part, and the functional part; accessible upon authentication and authorisation, to "users" and "data or user administrators". The supported functions include data file upload and validation and reporting of coverage estimates. On the publicly accessible part, the visitor can operate the elements of the navigation bar (i.e. Home, Countries, Coverage in Europe, Coverage on age and Coverage methods) to display: for example, measles-containing vaccine (MCV) coverage in different patterns. The platform's present link is: *http://eujav-platform.com/*

Standardised estimations of vaccination coverage

National measles-containing vaccine (MCV) coverage is reported to WHO yearly; but due to the different methods the countries are using to obtain vaccine coverage data (i.e. national or subnational surveys, administrative methods, or vaccination registries), the data is published annually with several months delay. The EU-JAV Experts on Vaccine Coverage and Reminder Systems put in their target to standardise the assessment of vaccination coverage by establishing common methodological guidelines, data structure and criteria for standardised estimations of vaccination coverage. The R-package was developed as a tool to do timely and standardised estimations of MCV coverage within and between three partner countries (all with operating IIS in place), and to identify immunity gaps at national and regional level.

The estimated standardised MCV coverage using the R-package enabled among other, the coverage display on maps allowing each country to identify differences in coverage between regions, or even to identify if the observed differences in coverage between regions or countries were due to any delay in vaccination with regard to the national recommended age at vaccination. The estimated standardised MCV coverage using the R-package enabled the fast preparation of maps especially useful in areal case of emergency such a measles outbreak is discovered and a vaccination campaign has to be planned in relevant areas with short notice

Several European countries are setting up IIS systems; with real-time access to population and vaccination data, the R-package and the pilot platform are powerful tools to identify immunisation gaps.

Reminder systems

Reminder systems aim to help people not to miss a vaccine dose; several studies to improve immunisation rates. The EU-JAV Experts examining vaccination reminder systems, investigated whether automatic vaccination reminders/recall were sent out by the regional or national immunisation Information system (IIS) in place. They also explored what methods had the countries employed to remind population about vaccinations when the IIS was not used for this task, what were the barriers (languages, social, cultural) identified towards the implementation of vaccine reminder systems, and which were the most optimal reminder systems.

The questionnaire responses of the 17 (Austria, Croatia, Denmark, Finland, Flanders [Belgium], France, Greece, Italy, Latvia, Malta, The Netherlands, Norway, Romania, Slovakia, Slovenia, Spain, and Sweden) out of 20 participating countries on if and how parents/recipients were reminded about upcoming or missed vaccinations. The survey findings included: Reminders are used in countries with and without an IIS in place; the reminder systems are well-accepted by the population; the nature of IIS in place varies between countries; in three out of 17 countries, reminders are being translated to foreign languages to reach individuals with foreign background; phone and SMS were found to be the most widely used reminders; e-mail, letters, webpage, regional newspapers are also used in some countries; it was not possible to identify if one method was more efficient compared to another. The actors in charge of the reminding programmes varied from a national one, to a regional or even more decentralised one managed for example by baby clinics or school healthcare.

In connection with the work on immunisation information systems (IIS), the European Joint Action on Vaccination included a feasability study of a coordinated cross-border measles catch-up vaccination campaign envisaged to tackle common immunity gaps in older children and adults that have not been vaccinated against measles as part of the regular national childhood immunisation programmes (NIP). Due to a lack of data in several crucial fields, the EU-JAV Team finally chose to review the experience and best practice on what has already been done regarding cross-border immunisation actions, and what can be gained by teaming up, as well as the facilitators and barriers, to inform future coordinated cross-border vaccination campaigns. Also, following a request by the European Commission, all vaccines recommended by the NIPs, as well as covid vaccination have been included in this review.

In total, 13 topics appear to be relevant regarding cross-border vaccination campaigns: adult vaccination, collaboration with pharmacists, policy advocacy, healthcare worker training, technological tools, communication strategies, populations with low vaccination rates, comparable data on vaccine uptake, risk communicator training, neighborhood / twinning initiatives, coordinated literature reviews, key messages of 'one voice', and stakeholder engagement.

Vaccine Supply and Preparedness

Previous experiences with vaccine shortages and responses at national and European levels

Vaccine shortages are a serious public health issue, that can lead to missed opportunities for vaccination, and to a greater risk of occurrence of deadly vaccine-preventable disease.

In Europe, many countries are facing important challenges in this respect. Preventing vaccine shortages is a top priority in the EU and globally, as highlighted during the 68th World Health Assembly (2015), and in the EU Commission 2018 Council Recommendation on strengthened cooperation and coordination between EU countries, industry and other relevant stakeholders, against vaccine preventable diseases; it included the strengthening of vaccine supply, procurement and stock management. The EU-JAV Experts performed between February and May 2019 a survey on previous and ongoing vaccine shortages and stock outs in Europe in the years 2016-2018, among persons in charge of the national or subnational immunisation programme(s) or of vaccine supply/procurement in EU/EEA and consortium (EU-JAV) Member States (MS). A total of 22 countries participated; overall, 115 shortage and stockout episodes were reported in the three-year study period, 23 of which caused a disruption in immunisation services.

• The most frequently involved vaccines were diphtheria-tetanus (DT) -containing combination vaccines, and hepatitis B, hepatitis A, and BCG vaccines.
• The median duration of shortages/stockouts was five months (range <1 month - 39 months).
• The most frequently indicated cause of shortage was interruption in supply (due to quality issues or for other reasons), particularly for BCG and DT-containing vaccines, but also for hepatitis B (adult), hepatitis A (adult), and combined hepatitis A+B. Global shortage also played a major role, especially for BCG, DT-containing vaccines, hepatitis A, hepatitis B and rabies vaccines.
• Regarding procurement procedures, most countries reported to procure vaccines at national level by the public sector. The preferred purchase mechanism is based on competitive bidding: 13 countries purchase all or at least some vaccines from more than one manufacturer. Fourteen countries report using multi-year contracts for all vaccines.
• Sixteen countries stated that they keep stockpiles of vaccines.
• Only little more than half of countries surveyed reported having an immunisation supply chain improvement plan and a vaccine supply manager at national level.

Besides vaccines, the survey also identified the occurrence of shortages of biological products such as antitoxins and immunoglobulins. Overall, 25 shortages/stock outs were reported by 17 countries. The most frequently reported event was short- age/stockout of diphtheria antitoxin, reported by 12 countries.

In addition to the survey, the perspectives of two main stakeholders' (Vaccines Europe and the Europe- an Medicines Agency) were also collected.

In conclusion, results of the survey enable us to better describe vaccine shortages and stockouts in Europe, their impact and main causes. In addition, the survey results provide some insights into the procurement and tendering mechanisms used in EU/EEA countries. This information, together with information collected from the literature, and stakeholders' views, bring us to make the following general considerations and recommendations:

- **More research is needed on the causes of vaccine shortages and their interplay.**
- **There is a need for all countries to have an immunisation supply chain improvement plan, and a vaccine supply manager at national level.**
- **Improved communication between public health.**
- **Procurement and tender mechanisms should be improved and take into consideration, among others, multisource suppliers, other factors besides price, and the length of contract.**
- **In case of vaccine shortages, all countries should have procedures or recommendations in place regarding the use of alternative vaccines or vaccination schedules during the shortages.**

Financial mechanisms underlying vaccine procurement: Is a joint procurement procedure possible?

In parallel with the study on vaccine shortages, and to further analyse the ecosystem that maintains the supply of vaccines, the EU-JAV examined and evaluated the local financing mechanisms for purchase and stock of vaccines, and explored the room for joint procurement.

First, at a workshop in Rome (October 2019), the EU-JAV consortium member states and main stakeholders the explored together the feasibility of centralised procurement of vaccines and whether this could be a possible solution for mitigating vaccines shortages. They evaluated advantages and disadvantages of centralised versus self-procurement of vaccines investigated, among Member States, local financial mechanisms for vaccine procurement, experiences with
and opinions on joint procurement.

Second, the EU-JAV Experts, through the review of background literature, compared **the two different types of procurement: self and joint**. Self-procurement occurred at the national or subnational level, whereas joint procurement methods were rarely used and often limited to low and middle-income countries, and this could reduce the generalizability to the EU/EEA context. In addition, information on the impact of current vaccine procurement methods on the performance and sustainability of vaccination programs was limited.

Third, they designed and conducted a three-month (August to October 2020) survey among persons in charge of the national or subnational immunisation programme(s) or of vaccine supply/procurement in EU/EEA and EU-JAV consortium Member States (20 EU-JAV EU/EEA countries, 8 EU/EEA).

For the majority of countries:

- Vaccines included in the national vaccination schedules were entirely state/government (central or subnational) funded, with health insurance contributions either directly funded by the central government or with reimbursement of costs to be other sources of funding.
- Vaccines included in the national vaccination schedules were entirely funded by the national or subnational government.
- Decision-making regarding financing the introduction of a vaccine is based, among other things, on NITAG recommendations.
- Most countries reported using price as the first criteria, with only three countries using quality criteria.
- Main strengths of the current procurement method included transparency, homogeneous and adequate prices and equal access to vaccines; while main weaknesses included the high level of bureaucracy and long and complex tendering procedures.

Overall, the current financial mechanisms for vaccine procurement used in the surveyed countries seem to function well and in general, these countries being satisfied with their procurement process.

Regarding **joint procurement** of vaccines, most countries:

- agreed this financing mechanism for vaccine procurement could contribute in improving country's preparedness in the event of serious cross-border health threats caused by vaccine preventable diseases
- enhanced other forms of cross-border collaboration regarding decision-making during national procurement (i.e. sharing vaccine price information, conducting joint market research, sharing information and discussing tender processes and supplier insight)
- possible advantages of these collaboration models also include increased transparency on prices, increased negotiating power, and decreased prices and administrative costs

We can draw several conclusions from this work:

- Longer term planning regarding vaccine procurement is recommended, as it allows a more comprehensive view of future vaccine demand.
- Price should not be the only criterion considered in vaccine tenders, as it may be a disincentive for manufacturers to participate in tenders and invest in R&D. This would allow a range of suppliers to be available, which is one of the requirements of a healthy market.
- The majority of participants reported being favourable to joint procurement of vaccines during serious cross-border health threats caused by vaccine preventable diseases. Other forms of cross-border collaboration (such as sharing vaccine price and other market information), and lending of vaccines in case of vaccine shortages have been used in the EU, and should be encouraged.
- Availability of a regional EU data warehouse of supply and demand could be a step in this direction.

The example of the Covid-19 vaccine procurement

The common procurement of Covid-19 vaccines, led by the European Commission, with the participation of all EU Member States, is a very recent and important example of a common approach taken to procure vaccines in the EU during an international health threat, as well as the financing mechanism used. Advanced purchase agreements were used and these have been a crucial element contributing to the European response to fight the Covid-19 pandemic. Thanks to the common EU Vaccines Strategy, the Commission was able to build a diversified portfolio of several vaccines, based on different technologies, from several suppliers, at a fair price, and has ensured access to Covid-19 vaccines for all Member States. The strategy also enabled the support and speeding up of development and manufacturing at scale of Covid-19 vaccines and allowed the exportation of doses to over 100 countries worldwide. In order to strengthen the EU preparedness and response in future health emergencies, in November 2020, the Commission, among other initiatives, set out the main elements of the future Health Emergency Response Authority (HERA), launched by the end of 2021. HERA is part of the European Health Union and will provide a dedicated structure to support the development, manufacturing and deployment of medical countermeasures (including vaccines) during a health crisis of natural or deliberate origin.

Anticipation of needs to ensure sufficient size of supply and stockpiles

Aiming at reinforcing mechanisms of management of vaccine supply, the EU-JAV Experts sought **to understand how could the sufficient size of vaccine supply and stockpiles be ensured**.

By surveying the stakeholders' and EU Members States' opinion on key mechanisms on vaccine supply and stockpiles management, as well as on the need, relevance, and specifications for a European-wide data repository regarding vaccine demand and supply, it was identified that **the reinforcement of a timely planning of vaccine supply and stock at a national level was highly needed**, to manage the impact the limited number of manufacturers and worldwide production capacity are having on vaccine demand and supply.

Key-mechanisms for ensuring sufficient supply according to participating countries were: Early warning systems from suppliers and manufacturers of potential stockouts; sufficient stockpiles of vaccines at national level including an emergency stockpile; the comprehensive national overview of vaccine demand and stocks.

Key-mechanisms for improving forecast of vaccine demand and manufacturing, included: long-term vaccine forecast from government agencies and procurers and timely input from government agencies and procurers on future demand related to potential changes in the national immunization.

For improving **the exchange of vaccine supply, harmonizing labeling of vaccines** was mentioned as an important tool.

On the issue of the **exchange of vaccine supply**, the EU-JAV Experts explored the feasibility of an EU data warehouse for sharing of vaccine supply and demand data among dedicated stakeholders; and assessed whether a **virtual stockpile monitoring tool** or other type of **rapid exchange mechanism** could be useful, and if such a tool should be restricted to specific vaccines only with an impact on public health and national security.

As most important for a virtual stockpile monitoring tool or other type of rapid exchange mechanism, the countries listed the following focus areas: rarely used vaccines and immunoglobulins; vaccines to be used during epidemic outbreaks; Vaccines for emerging infectious diseases. The feedback reflected that most failures in vaccine supply are due to the unpredictable nature of outbreaks and rare events; the uncertainty regarding national stockpiles kept by some member states to protect against potential outbreaks; and the still missing, global overview of the size of these stockpiles and how they are forecasted by each member state - all of which at risk of impacting the vaccine supply needed to contain emerging threats (i.e. measles), and with lower risk regarding other vaccines included in the national standard
immunization program.

As key-mechanisms enabling vaccine exchange between EU countries were listed the rapid exchange mechanism on available vaccines between EU member states, the harmonised labelling of vaccines in the EU, and establishing liability protection for parties involved in making the vaccines available.

The EU-JAV Experts identified and communicated the reflected need for further discussion regarding the development of a standard operating procedure regarding the urgent exchange of medical countermeasures through the Early Warning and Response System (EWRS) raised by the European Health Security Committee (HSC).

Further work on the concept analysis for a regional European data warehouse for sharing data/information of vaccine supply and demand among dedicated stakeholders should include several options, such as not having a data warehouse (status quo), as well as having different models of voluntary sharing of specific vaccines using a rapid exchange mechanism on available vaccines between EU member states.

The common procurement of Covid-19 vaccines has additionally provided the EU member states with experience in sharing mechanisms for surplus vaccines during an emergency, for 2 main reasons:

- Through the advanced purchase agreements with individual vaccine producers, the Commission secured the right to buy a specified number of vaccine doses in a given timeframe.
- Moreover, through the EU vaccine strategy, the surplus vaccines have been donated, and the donor-funded vaccines have been shared with the global collaboration COVAX, which enables low and middle-income countries to access Covid-19 vaccines.
- In addition, the Member States have gained experience with mechanisms and procedures for bilateral donations, i.e., import and export of Covid-19 vaccines.

These new experiences will probably affect the member state view on these questions; the EU-JAV results need to be considered in this context.

Research Priority Identification and Funding Cooperation

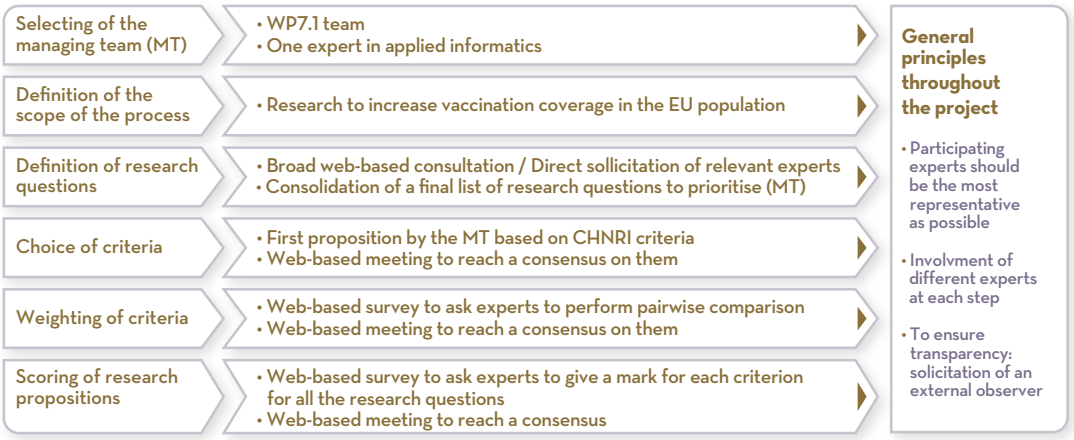
The EU-JAV aim was to propose a shared funding on common priorities among member states in the European Union.

The research funding system in Europe is very complex, with many actors, and a great diversity of possible topics, in a context of limited resources; it appears therefore necessary to prioritize research questions through a transparent, evidence-based selection process carried-out rigorously, in accordance with best practices. Thereafter, the EU-JAV Experts set to work:

- develop and implement a prioritisation framework to identify research priorities in Europe and the area of vaccine and vaccination research (vaccine R&D).
- increase collaboration regarding the funding of research.

Guidelines to establish priorities for vaccination research and increase vaccination coverage

The EU-JAV, based on the literature review and experts' interviews, elaborated **a prioritisation framework which they piloted twice. The framework was designed on a multi-criteria decision analysis** – adapted from the Child Health and Nutrition Research Initiative (CHNRI) by Rudan et al – and was refined and improved throughout the project with the EU-JAV Experts professional review and the advice from participating experts.



Steps of the prioritisation framework

The general principle of the framework is that each research proposition is assessed through a series of steps (detailed in figure 1: step of the prioritisation framework).

• First, the key research question was defined (through broad consultation) and in parallel, the first group of experts was tasked to select criteria for prioritisation of research questions, taking into consideration the ultimate goal of the exercise.
• Next, another group of experts had to assess a weight to each of the criteria, using pair-wise comparisons.
• The final step consisted in gathering experts who assessed each research question against the weighted criteria.
• Through this evaluation, each individual research question was assigned a score and was then ranked in order of priority.

Following the prioritisation framework, the EU-JAV Experts determined research priorities on vaccination, with a list updated annually.

Annual list of research priorities on vaccination, covering most vaccines used in the EU, and for which research might provide insights on how to maximise coverage

During the time of the EU-JAV projects, two annual research priorities lists for vaccine and vaccination research were established using the prioritization framework:

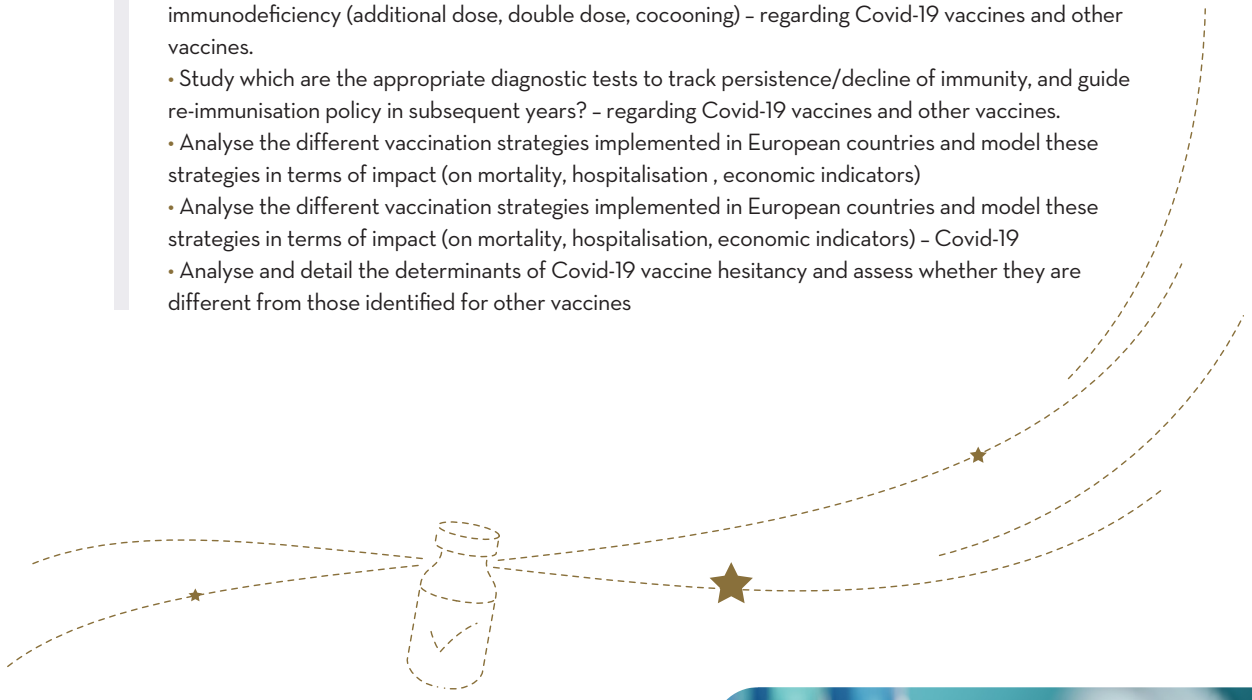
- The first focused on four pilot vaccines (Influenza, Measles-containing vaccine, HPV and pertussis);
- The second list was extended to all vaccines.

Some of the top-research priorities from the first exercise performed in 2020 were:

- Investigate the effectiveness of various influenza vaccine formulations and products (live attenuated, high-dose, adjuvanted, quadri- vs tri-valent, cell-based, recombinant) in key target groups, i.e. (very) young children, frail and institutionalised older persons
- Evaluate the effectiveness of vaccinating children of various ages on protecting vulnerable persons (in particular elderly family members) against influenza
- Investigate across Europe whether and to what extent authorising pharmacists to administer seasonal influenza vaccine to the general population increases influenza vaccination coverage

Some of the top-research priorities from the second exercise performed in 2021 were:

- Generate evidence to optimise vaccine strategies for people with underlying conditions, including immunodeficiency (additional dose, double dose, cocooning) – regarding Covid-19 vaccines and other vaccines.
- Study which are the appropriate diagnostic tests to track persistence/decline of immunity, and guide re-immunisation policy in subsequent years? – regarding Covid-19 vaccines and other vaccines.
- Analyse the different vaccination strategies implemented in European countries and model these strategies in terms of impact (on mortality, hospitalisation , economic indicators)
- Analyse the different vaccination strategies implemented in European countries and model these strategies in terms of impact (on mortality, hospitalisation, economic indicators) – Covid-19
- Analyse and detail the determinants of Covid-19 vaccine hesitancy and assess whether they are different from those identified for other vaccines



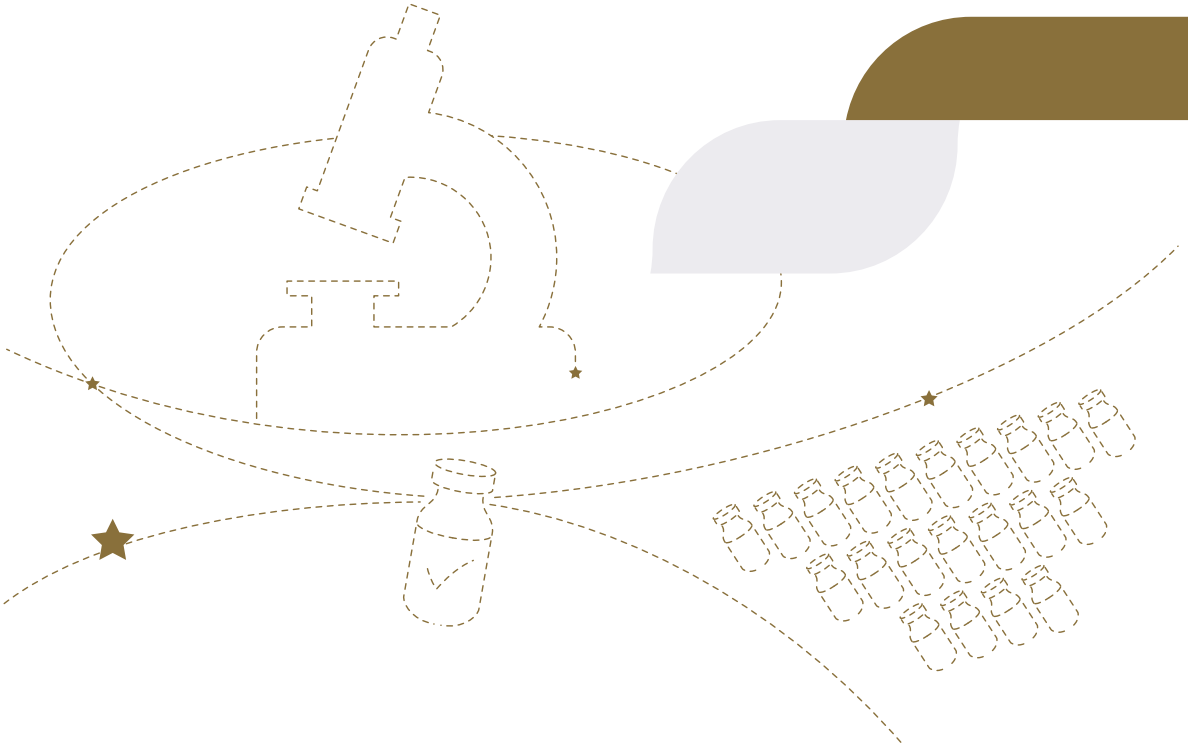
Potential mechanisms to increase funding collaboration in vaccine and vaccination research

After the elaboration of the method to identify the annual top-research priorities list, and aiming to propose a shared funding on vaccine research among member states in the European Union, the EU-JAV Experts performed a **survey and the literature review of existing funding mechanisms** and determined a potential mechanism to increase collaboration in vaccine and vaccination research and cooperation for funding of identified priorities.

A literature review of existing and possible funding mechanisms for vaccine research and development was carried out in 2019 to gain an overview of organisations providing funding of vaccine R&D and vaccination research. Then, a survey towards organisations funding research was carried out during spring 2019. The aim was to use the combined findings from the survey and the literature review of existing funding mechanisms to propose a potential mechanism to increase collaboration in vaccine and vaccination research and cooperation for funding of identified priorities.

One area mentioned as particularly relevant for collaborative funding within the vaccine field was late-stage clinical trials and phase III/phase IV trials.

In addition, more research on implementation of new vaccines in national public health programmes and follow-up on long-term safety and safety signals should be prioritised. Moreover, it is increasingly important to prioritise and finance research to better understand mechanisms of vaccine hesitancy in a coordinated approach among the member states of the European Union.



Vaccine Hesitancy and Uptake

Best practices to address vaccine hesitancy and monitor public vaccine confidence in the online sphere

The EU-JAV Experts had been tasked to develop a systematic overview and analysis of the current situation of activities related to vaccine hesitancy and uptake, including best practices and lessons learnt in Member States and their regions.

The first stem aimed at mapping of the activities related to vaccine hesitancy and uptake in the Member States and their regions, and among stakeholders. To gather such data, the EU-JAV Experts conducted a survey in 32 countries and of 32 EU-JAV stakeholders. In total, 28 countries and 8 stakeholders responded to the survey.

The analysis of the responses revealed important facts, either barriers or enablers to improve vaccine coverage. These include:

1 • **The definition of vaccine hesitancy has many interpretations.** Vaccine confidence, or lack thereof, is perceived to be the dominating feature of vaccine hesitancy. However, it is important not to leave any of the components of vaccine hesitancy (such as complacency and convenience) behind.

2 • **Determinants of vaccine hesitancy are also understood primarily from the perspective of a lack of confidence. This lack of confidence** is rooted within vaccines' safety and effectiveness profiles, or may be more broadly due to ideological or religious reasons.

3 • **From a public health and policy perspective, inconsistent terminology** – and focusing only on vaccine confidence, or the lack of it, and overlooking other factors of vaccine hesitancy, such as convenience and complacency – **means that programs designed to reduce vaccine hesitancy and strengthen uptake may be too narrow or improperly focused**.

4 • **The most emphasised practices among the countries were communication activities and work related to healthcare workers (HCWs), followed by cooperation with government bodies**.

5 • The vaccines or subgroups perceived to be responsible for suboptimal vaccine uptake do not completely match with the target of work conducted by health departments. In this work, there are under-served groups, such as HCWs, or under emphasised vaccine, such as pneumococcal, in vaccine uptake work.

6 • **The work to improve vaccine uptake has focused heavily on the human papilloma virus (HPV) and influenza vaccinations**. However, none of the work primarily targeted the vaccine with the reportedly lowest/most decreasing coverage in some countries: the pentavalent (diphtheria, tetanus, pertussis, polio, *Haemophilus influenzae* type B) vaccine; and the pneumococcal vaccines were rarely mentioned as targets at all.

7 • **Official websites, HCWs, and informational literature are all the most highly emphasised for communicating both information on vaccines and information on vaccine safety.** HCWs are trusted intermediaries in delivering vaccine information to their patients.

8 • **The benefits of working across borders can include sharing experiences and data, as well as the possibility to collaborate on reviews of the international scientific literature.** Barriers are identified as socio-cultural, institutional and resources. The report includes a number of examples of international initiatives which have facilitated cross border collaborations linked to vaccine hesitancy and uptake.

9 • **What is left unanswered from these results is a deeper look into the public's mind of what is driving the lack of confidence**.

10 • **Organisational barriers, personnel shortages, and lack of funding are listed as the most common barriers to working on vaccine uptake and vaccine hesitancy issues**.

Support for effective programme implementation

In May 2020, the Vaccine Hesitancy and Uptake Network was launched on the EU Health Policy Platform. The aim of the network was to provide support for developing practices and policies for maintaining good vaccine uptake and for strengthening public health responses to vaccine hesitancy and uptake issues in the European countries. The contents on the Vaccine Hesitancy and Uptake Network was based on the work done in the EU-JAV.

In practice, the network provided:

- Descriptions and presentations of good practices related to vaccine hesitancy and uptake (studies, campaigns, publications, activities);
- Results from the data gathering on barriers and enablers behind suboptimal vaccination coverage;
- More than 60 publications in total (February 2022);
- Possibility to organise webinars;
- Possibility to search information using key-words.

The EU-JAV Experts have developed a platform aiming to monitor population sentiment and opinions towards vaccines and vaccination as expressed on social media and more generally online, and to identify the most influential online players on vaccine-related topics.

In the end, the goal of the platform is to inform healthcare professionals, public health authorities, and policy makers about users' interest and opinions towards vaccines, and about the occurrence of vaccine hesitancy (that could have a negative impact on vaccination uptake). It may also inform public health authorities in a timely manner of significant vaccine-related online events, especially those for which a rapid response is important, for example, to help decrease the spread of false information.
The platform is composed of a data aggregator, a machine learning classifier, and a data visualiser.

The analyses performed through this EU-JAV platform in the past year led to the following recommendations:

1. Event detection systems can help spotting the emergence of critical communication issues.
2. Constant monitoring of influencers in the online vaccine discourse helps to timely identify fake news that have the potential of becoming viral.
3. Develop, validate and constantly update keyword filters based on structured frameworks.
4. Qualitative analysis of samples of social media posts is useful to dive deeper into contents.
5. An algorithm for stance analysis is mandatory to analyse large volumes of tweets, but needs retraining in time because language and contents change.
6. Vaccine hesitancy is context-specific.

Disseminating Lessons Learnt

Stakeholder Analysis

To implement relevant communication and activities with vaccine stakeholders in Europe, an analysis cross-referencing the known data of the said stakeholders and the project topics has been conducted early on.

Several issues from the project were highlighted that allowed an identification and selection of the relevant stakeholders:

Children & adult vaccination	Seasonal vaccinations	Vaccine hesitancy	Vaccine demand forecasting and supply information	Vaccine research and development

All of these stakeholders were then assessed to provide a list of potential interest for the project thanks to a set of their characteristics, such as power, interest, and their legitimacy to engage in the EU-JAV.

Partners in the EU-JAV identified 526 national and 53 international stakeholders, and provided data on the characteristics of 444 of them.

Among those, almost half of the identified stakeholders have the power and resources to engage meaningfully with EU-JAV and contribute to the progress and outcomes of the project. Most national Authorities belong to this category, as do Research and Academia and most representatives of healthcare. This represents an opportunity to strengthen the influence of the EU-JAV and to broaden the pool of knowledge and valuable research contribution of the project. Thus, involving these stakeholders in outreach activities (workshops, web-conference, etc.) or via direct collaboration on appropriate tasks and activities (advisory groups, etc.) would be beneficial.

The second most important group includes stakeholders who do not have the resources to contribute greatly to the project and its outcomes. They are nevertheless legitimate to engage with the project regardless of their benefits or losses.

It should be noted that the healthcare field either falls into the first or second category, depending on the partner country. Indeed, in some of the EU-JAV Member States, associations of doctors and other health professionals have few resources, influence or authority whereas in others it's the other way around. These stakeholders therefore need to be supported by improving their capacity and access to participation and meaningful engagement in the issues of the EU-JAV.

Two issues were highlighted by all the identified stakeholders: vaccine hesitancy and seasonal vaccination. They will have to be taken into account throughout the project so that it remains as inclusive as possible.

Finally, to enrich the lists of stakeholders throughout the duration of the project, all partners were asked to do a continuous/regular update.

Disseminating tools and activites

In order to successfully contribute in building confidence in the benefits of vaccination, it was essential to make the European Joint Action on Vaccination (EU-JAV) - in its entity (design, scope, goals, axes of study, research studies, reached results, formed conclusions or recommendations) - known to any European citizen, with genuine interest or professional focus in vaccines and vaccination. The information produced by the work of the different teams of EU-JAV on the joint action five axes of research study, were disseminated to all different groups with special interest in vaccines and vaccination, in the most efficient and attractive way, through contemporary media and social networks, following the design trends of today.

Dissemination tools

- Strategic Dissemination Plan
- Stakeholder Mapping 2021
- EU-JAV website
- EU-JAV leaflet (×2)
- EU-JAV booklet
- EU-JAV Facebook page
- EU-JAV Twitter account
- EU-JAV YouTube channel
- EU-JAV Instagram account
- EU-JAV LinkedIn account
- EU-JAV Virtual one-day meeting (15.10.2021)
- EU-JAV hybrid closing conference (09.03.2022)
- Final Dissemination Report 2022

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