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To cite this article: Andrea Poscia, Giulia Paolorossi, Agnese Collamati, Claudio Costantino, Daniel Fiacchini, Claudio Angelini, Roberto Bernabei, Daniela Cimini, Giancarlo Icardi, Andrea Siddu, Andrea Silenzi, Antonietta Spadea & Davide Liborio Vetrano (2024) Enhancing routine immunization efforts for older adults and frail individuals: Good practices during the SARS-CoV-2 pandemic in Italy, *Human Vaccines & Immunotherapeutics*, 20:1, 2330152, DOI: [10.1080/21645515.2024.2330152](https://doi.org/10.1080/21645515.2024.2330152)

To link to this article: <https://doi.org/10.1080/21645515.2024.2330152>



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Published online: 27 Mar 2024.



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RESEARCH ARTICLE



Enhancing routine immunization efforts for older adults and frail individuals: Good practices during the SARS-CoV-2 pandemic in Italy

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ABSTRACT

Infectious diseases pose a significant burden on the general population, particularly older adults who are more susceptible to severe complications. Immunization plays a crucial role in preventing infections and securing a healthier aging, but actual vaccination rates among older adults and frail individuals (OAFs) remains far from recommended targets. This study aims to collect and share good practices implemented in several Italian local health districts during the SARS-CoV-2 pandemic to ease routine immunization for OAFs. A 28-items questionnaire has been developed to collect information on organization aspect of immunization services and local good practices implemented before and during the SARS-CoV-2 pandemic. Twelve Public Health managers representative of 9 Italian Regions were further interviewed between January and March 2021. Despite literature suggests several effective interventions to increase vaccine demand, improve vaccine access, and enhance healthcare providers' performance, our survey highlighted substantial heterogeneity in their implementation at local level. Seven good local practices have been identified and described: mass vaccination centers; vaccination mobile units; drive-through vaccination; co-administration; tailored pathways; cooperation among providers involved in vaccination; digitization. Our survey pointed out valuable strategies for enhancing routine immunization for OAFs. Providers should combine effective interventions adequate to their specific context and share good practices.

ARTICLE HISTORY

Received 28 December 2023
Revised 1 March 2024
Accepted 10 March 2024

KEYWORDS

Infectious diseases; vaccination coverage; older adults; frail; SARS-CoV-2; pandemic; good practices; routine immunization; Italy


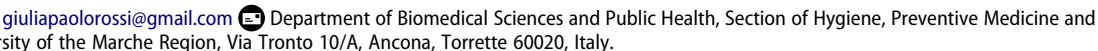
Introduction


Infectious diseases continue to pose a significant burden in terms of hospitalization and mortality within the general population, as exemplified by the SARS-CoV-2 pandemic. One of the key strategic objectives outlined in the Global Vaccine Action Plan for the period 2011–2020 was to expand vaccination coverage, with particular attention given to the most vulnerable individuals.¹

As individuals age, they become more susceptible to infections and severe complications due to a diminishing capacity to respond effectively to external stressors.^{2–5} Growing evidence suggests that infections and frailty repeatedly cross each other pathophysiological pathways and accelerate the aging process in a vicious circle.^{6–8} Efforts aimed at preventing both frailty and infections have the potential to delay the onset of chronic illnesses and enhance the overall well-being and longevity of elderly individuals. A mounting body of evidence links the vaccination of older adults to the concept of active

aging.^{9–12} In this regard, Italy offers one of the most extensive ranges of free vaccinations for older adults. The National Vaccine Plan for older adults includes vaccines against tetanus, diphtheria, pertussis, herpes zoster, pneumococcus, and influenza.¹³

Despite the availability of safe and effective vaccines, there is globally a significant gap between the recommended coverage targets and the actual vaccination rates among older adults and frail individuals (OAFs).^{10,14} Unfortunately, there is a lack of comprehensive data on vaccination coverage specifically among the elderly population, making it challenging to comprehensively appraise the phenomenon. At the same time, a between-country comparison can be made using the data available for influenza immunization. Although the target for influenza immunization among older adults is 95%, the latest available vaccination rates was only 58.1% in Italy, the highest in UK (80.9%), the lowest in Turkey (5.9%).^{15,16}

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 Supplemental data for this article can be accessed on the publisher's website at <https://doi.org/10.1080/21645515.2024.2330152>.

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The SARS-CoV-2 pandemic had a significant impact on the availability and accessibility of routine vaccines, particularly for OAFs. The adult population, faced considerable challenges as a result of emergency mobility limitations implemented to mitigate the spread of infections and the progression of the pandemic.¹⁷ The population aged 65 and above, in particular, experienced significant disadvantages due to the epidemiologic circumstances. If on one hand they were afraid of suffering from more severe SARS-CoV-2 infections and complications, on the other hand they have been penalized by the suspension and reorganization of vaccination centers to adhere to social distancing measures, the reassignment of staff members engaged in SARS-CoV-2 contact tracing activities, and the impact of SARS-CoV-2 infections among healthcare workers.¹⁷ Italian vaccination services have implemented several strategies to ensure the provision of vaccinations during the SARS-CoV-2 pandemic, such as: prioritizing specific vaccines or patient groups and extending operating hours to prevent overcrowding. Despite these efforts, certain vaccination outcomes have been negatively impacted. Notably, vaccines for herpes zoster and pneumococcus, which received special recommendations from the Ministry of Health, experienced delays in immunization schedules. Consequently, the Ministry has called for innovative solutions to expedite catch-up vaccinations and ensure swift immunization coverage for the entire population during the SARS-CoV-2 vaccination campaign.¹⁸

The scientific literature has extensively recognized the factors that hinder the attainment of optimal vaccination coverage among adults. These obstacles include unawareness of recommended vaccines and benefits of immunization, challenges in vaccination services accessibility, difficulties in coordinating adult care, inconsistent advice from healthcare workers and the requirement for payment of benefits in countries lacking free healthcare services.^{19,20} In literature “Good practice” refers to a set of guidelines, methods, or techniques that are generally accepted as effective and efficient in a specific context. “Best practice” refers to the most effective and efficient methods or techniques that have been identified and established through research and experience. Good practices are generally accepted as effective, while best practices are demonstrated to be the most effective and efficient methods in a specific context. Best practices are considered superior to good practices due to their validated effectiveness and superior results.

Numerous studies have been conducted to evaluate the real-world effectiveness of interventions aimed at enhancing vaccine coverage within the adult population.¹⁹ However, despite these efforts, achieving optimal vaccine coverage remain a distant goal.¹⁹ This study aimed to identify and describe local interventions in the Italian healthcare system allowing the dissemination of relevant good practices to improve routine immunization for older adults.

Materials and methods

Italia Longeva, the National Association for active aging and longevity, carried out this survey to investigate immunization practices and innovative solutions for OAFs, particularly in a context of significant organizational pressure created during the SARS-CoV-2 pandemic.

A questionnaire has been used as a guide for semistructured interviews with public health managers from relevant territorial entities (Regions, Local Health Authorities (LHA)).

The questionnaire has been developed conducting a scientific literature review using the Pubmed and Google Scholar databases and gray literature review using the Google search engine. The initial version of the questionnaire – including 35 items – underwent review by a panel of experts (four specialists in: epidemiology, geriatric medicine, public health and communication). The first round of the Delphi survey^{21,22} was used to validate the items, the second round was used to reach consensus and to generate a final questionnaire version including 28 items. The Italian full version of the questionnaire is available at the Italia Longeva Website²³; a translation in english is available as supplementary material. The questionnaire was organized into three sections:

- (a) **Routine organization of vaccine services for the OAFs.** This section aimed to describe the key aspects in terms of **organization and delivery of vaccination programs for OAFs** in the interviewed entities.
- (b) **Good vaccination practices active in the pre- SARS-CoV-2 era.** This section aimed to describe the level of implementation at the local level of the best practices already consolidated in the literature. Gray and scientific literature review was conducted with a combination of the keywords “intervention (increase or improve or ameliorate) (vaccination or immunization) (elderly or older)” and 27 best practices were identified. They were grouped into three types according to the Community Preventive Services Task Force definitions: increasing community demand, enhancing access, and provider or system-based interventions.^[24]
- (c) **Good vaccination practices during the SARS-CoV-2 pandemic.** This section aimed to describe the most promising strategies on routine immunization carried out at local level during the current SARS-CoV-2 pandemic context to improve vaccination coverage among OAFs. Seven good practices have been identified and discussed during a workshop organized by Italia Longeva on 21 April 2021 (in virtual mode) and then systematized and synthesized with this article.

The expert’s recruitment was based on:

- (a) Interest expressed by participants attending Italia Longeva annual event, “Long-Term Care Five – The States General of Long-Term Care,” held on December 1-2, 2020 in which a brief project outline and the data collection questionnaire have been presented.
- (b) Active search for additional best practices emerged during the interviews with the experts.

Finally, twelve public health managers from nine Italian Regions (covering a potential population of approximately 24 million, uniformly distributed between north, center, and

south of Italy) have been enrolled and interviewed between January and March 2021.

The survey results were analyzed using STATA v12 for mac software. Absolute and relative frequencies have been reported for qualitative variables.

Results

Routine organization of vaccine services for the OAFs

There was considerable variation in the organization of vaccine services across different Regions and even within the same Local Health Authorities. Some Regions reported a dedicated Complex Operational Unit focused on infectious disease prevention and surveillance, while others incorporated vaccine services into traditional Public Health Departments. In some cases, vaccine services were jointly managed by Department of Prevention and the primary care department. The allocation of spaces and staff also varied, with some Regions having separate resources for pediatric and adult vaccines, while others allocating different time slots for different populations. However, all included Regions were assisted by a Local Advisory Committee on Immunization consisting of experts in public health and additional members such as academics, representatives of Pediatricians or General Practitioners (GPs), Pharmacists, and other professionals involved as needed. Training of staff was a shared commitment among all vaccine services, with pre-pandemic activities primarily consisting of residential courses and improvement groups. These activities included large events to foster connections among stakeholders involved in vaccine prevention, as well as small group updates and improvement groups for specialist topics. However, due to the pandemic, training events were shifted to distance mode.

All the organizations that were surveyed reported space reorganization during the SARS-CoV-2 pandemics to ensure proper distancing between users of the vaccination center. Additionally, three out of four organizations interrupted vaccination services for elderly individuals, while still prioritizing vaccination for high-risk categories. In response to the emergency situation, vaccination centers implemented several strategies to adapt and optimize their services. These strategies included extending their opening hours, identifying new spaces within their existing facilities or other Health Centers,

and establishing mass vaccination centers that were later repurposed for SARS-CoV-2 vaccination.

Good vaccination practices active in the pre-SARS-CoV-2 era

The following sections describe the level of implementation at the local level of the 27 best practices identified through literature review and classified in accordance with the definition of the Community Preventive Services Task Force.

Good practices to increase vaccine demand (Table 1)

Among the nine types of interventions aimed at increasing vaccine demand, the interviewed experts indicated that there are partially or fully implemented systems to remind individuals of vaccination appointments or contact them again in case of missed appointment. Specifically, 44% of interviewees reported that patients were reached out by letter and/or leaflet/postcard, and 34% by mobile phone text message to remind the appointment and the location (Table 1). Furthermore, interventions for catch-up or cohorts recovery have been implemented. For example, active calls were made to individuals born between 1952 and 1955 who had not received anti-pneumococcal or anti-shingles vaccinations, as requested by the National Vaccination Plan.

Health promotion interventions were also employed to enhance patient awareness regarding the importance of immunization, in particular healthcare workers vaccines encouragement (44%) and patient awareness interventions employing a “peer-to-peer” approach (23%), such as phone calls made by seniors to advocate vaccination.

Economic incentives for vaccinated individuals have not been implemented and are not considered effective in this context, in consideration of the fact that vaccinations in Italy are generally provided free of charge and, more in general, it is controversial the use of economic benefits to persuade patients in healthcare setting.

Good practices to improve vaccine access (Table 2)

Among the six types of interventions aimed to improve vaccine access, all experts highlighted the provision of free vaccinations as a crucial strategy to overcome economic inequities. However, they also emphasized the limited applicability of this intervention due to resource constraints and the importance of health technology assessment. Additionally, 44% of surveyed

Table 1. Rate of reported implementation (%) of the nine interventions to increase vaccine demand.

Type of intervention	Interventions	Rate of implementation (%)
Client reminder or recalls	Letter/leaflet	11%
	Tailored letters or postcard	44%
	Telephone call from healthcare workers	11%
	Telephone call/text messages reminder appointment	34%
Economic benefits for vaccinated individuals	Supermarket gift card lottery	0%
	Other incentives for patients/families	0%
Patient education	Questionnaires on vaccination attitudes (including questions aimed at motivating the patient to get vaccinated)	0%
	Patient awareness employing a “peer-to-peer” approach	23%
	Patient awareness employing educated nurses	44%

Table 2. Rate of reported implementation (%) of the six interventions to improve vaccine access.

Type of intervention	Interventions	Rate of implementation (%)
Contextual vaccination with other events	Education and vaccination during training events	23%
Dedicated pathways	Access by groups (e.g., based on specific conditions)	44%
Home services	Home vaccination (by vaccination service, GPs or nurses)	100%
	Encouragement to get vaccinated during home visits (excluding home vaccination)	11%
	Inclusion in the Patient Care Plan of recommendation related to vaccine prevention (excluding home vaccination)	11%
Free vaccination	Vaccination free of charge	100%

institutions established dedicated pathways to facilitate access to vaccinations for specific patient groups such as transplant recipients, individuals with diabetes, and splenectomized individuals.

All respondents reported the availability of home vaccination services in their areas, mostly offered by general practitioners during home visits. These services, primarily utilized for influenza vaccinations, have been extended to other immunizations included in the National vaccination plan, but interventions targeting home care are considered marginal in terms of achieving better coverage. Nevertheless, they are considered ethically meaningful to ensure adequate protection for individuals who are unable to leave their homes. Challenges arise when considering the cost and organizational barriers associated with maintaining the cold chain required for storing vaccines during home visits.

Good practices to enhance provider/system performance (Table 3)

Among the twelve types of interventions aimed to improve the performance of healthcare providers, all experts highlighted the implementation of systems to facilitate the acquisition of healthcare autonomy through task-shifting. In the context of vaccinations, examples of such interventions include the use of a standardized triage, which is available and regularly updated in the guide to vaccine contraindications.²⁵ Adequate training and updates for staff involved in vaccinations are also provided through various means such as residential courses, distance learning, focus and improvement groups, or e-mail communication.

Of the interviewees, 67% reported the implementation of clinical audit interventions, which are considered highly promising to facilitate good practices comparison and

dissemination. However, their applicability is limited by the requirement of dedicated human resources. Other implemented interventions involve reminder activities for hospital specialists (65%) and GPs (55%) regarding patients who need to be vaccinated.

Hospitals are considered the ideal setting for identifying persons eligible for vaccination. However, it is important to note that hospitalization can often worsen existing pathologies and potentially contraindicate vaccination. In some Regions, the Regional Prevention Plan includes a mandatory field in the discharge letter to indicate recommended vaccinations according to the patient's conditions. Such initiatives have led to increased awareness among practitioners and patients themselves. Furthermore, hospitals have developed pathways for patients with allergies or multiple pathologies that require a specialized assessment of the risk–benefit ratio of vaccination based on their specific clinical conditions.

Good vaccination practices during the SARS-CoV-2 pandemic

The following section describe seven good practices resulting from the final workshop conducted at the end of the survey as the most promising strategies carried out at local level within the SARS-CoV-2 pandemic context to improve vaccination coverage among OAFs.

Mass vaccination center

During the first phase of the SARS-CoV-2 pandemic, it was important to maintain social distancing while optimizing the logistics of vaccination for a large number of persons. Large-scale vaccine centers, previously employed during the 2009 H1N1 pandemic and outbreaks

Table 3. Rate of reported implementation (%) of the twelve interventions to enhance provider/system performance according to the interviews.

Type of intervention	Interventions	Rate of implementation (%)
GPs/Hospitals staff reminders about patients who need vaccination	Reminder to GPs	56%
	Reminder to hospital staff to vaccinate patients	67%
	Include vaccination recommendations in discharge letters	56%
Healthcare providers competition Audit/Benchmarking	Making public differences in vaccination coverage between providers	11%
	Write audits/feedback to professionals/providers on vaccination performance	67%
	Benchmarking for the top 10 providers	11%
Staff training	On-site facilitators encouraging prevention, including vaccination	11%
	Academic courses/peer comparisons/focus groups	89%
	Leaflet sent via email	100%
Information systems	Facilitate the assessment of immunization status at every healthcare appointment	23%
	Create dedicated apps	11%
Task shifting	Standardized pre-vaccination screening checklist to facilitate task shifting (increased autonomy of healthcare workers in administering vaccinations)	100%

meningitis, allowed the catch-up of postponed vaccinations due to restrictive measures. Pediatricians and GPs involvement was essential for the successful implementation of vaccinations, enabling the administration of up to 1500 vaccinations per day in each single hub. A vaccine team, consisting of a doctor and a nurse, was able to vaccinate 20 to 30 patients per hour.

Mass centers organization requires fundamental collaboration between institutions, with municipalities playing a key role in identifying suitable locations and to ensure early organization. Third sector volunteers provided support to healthcare personnel and assist with patient guidance. Mass vaccination centers have the potential to achieve high coverage rates, improve networking among stakeholders and enhance customer satisfaction.

Vaccine mobile units

Mobile units for vaccination represented an alternative method and an opportunity to promote primary and secondary prevention through pamphlets or leaflets distribution. Outdoor vaccination helps maintaining social distancing, increases accessibility for patients who are typically less engaged in Public Health initiatives and allows the sponsorship of vaccinations and prevention interventions in locations highly attended by people. However, the choice of outdoor spaces is subject to weather conditions.

Drive-through vaccination

The experience gained from drive-through SARS-CoV-2 testing was also applied to vaccination drive-through, aiming to accommodate a large number of people within a small space and a short time frame (e.g., vaccinating one patient every two minutes). The transfer of vaccination administration into the passenger compartment of vehicles allows for adequate social distancing and optimization of logistics, facilitating rapid achievement of high vaccination coverage. The drive-through model has been proved useful for catch-up vaccinations, with invitations sent to patients at a rate of one patient every one minute, emphasizing the need to remain in the car and wear appropriate clothing.

Facilitate co-administration

Several *Local Advisory Committee* developed guidelines for vaccine co-administration to improve vaccination coverage and sessions efficiency. These guidelines provide updated, unambiguous and technically correct information on the safety and effectiveness of co-administration.

Providing precise information on co-administration solutions increases the engagement of healthcare operators and patients, reducing the need for multiple visits and expediting protection against preventable diseases.

Tailored pathways

Create pathways tailored to patients, dedicated to specific preventable diseases, is crucial to ensure early and complete care of vulnerable individuals with an increased risk of hospitalization and death. Several surveyed services scheduled vaccine appointments in discharge letters for splenectomized patients, administered vaccines during

dialysis for dialyzed patients, vaccinated HIV-positive individuals during infectious follow-up, and provided vaccinations to diabetics and transplant recipients during checkups at reference centers. Sharing evidence-based and patient-centered pathways through collaborative procedures between professionals strengthens collaboration between scientific societies, local healthcare providers, and hospitals, facilitating access to vaccination and the achievement of protection against vaccine-preventable diseases.

Strengthen cooperation among providers involved in vaccination

The increased workload in vaccine services, following the drafting of the Calendar for Life and the law 119/2017 on mandatory vaccination, prompted the Ministry of health to recommend collaboration between GPs, Pediatricians, and the Prevention Department. Involving pediatricians and GPs in the entire vaccination process, including information, promotion, administration, and registration, enables a greater number of vaccinations through the sharing of spaces, such as vaccine clinics, paths and healthcare workers. During vaccination campaign, the third sector plays a role in managing patient pathways, emphasizing the crucial collaboration between healthcare and non-healthcare staff in health emergency management and ensuring the safety of the spaces.

Another form of collaboration occurred between Hospitals and healthcare institutions. Hospital vaccination center offered the advantage of having inside all the necessary specialties for pre-vaccination consultations or for vaccinate in a protected environment. Additionally, by identifying University Hospital Centers, opportunities for multidisciplinary training and updates can be established, along with the possibility of conducting clinical studies on the effectiveness and safety of vaccinations.

Digitalization of records

The vaccination campaign highlighted the importance of real-time availability of digital vaccine status for booking appointments, consulting individuals' vaccination histories, and monitoring the progress of the campaign. While all the interviewed entities have computerized registries, complete vaccination histories for individuals born before 2000 are rarely available. Moreover, it is often challenging for doctors, including GP and specialists, to access shared patient information. However, there were successful experiences suggesting the possibility of rapid development of informatics systems capable of facilitating vaccination activities for vulnerable and elderly individuals. Some Regions have made collaborative efforts between GPs' records and vaccination registries, offering web applications accessible outside the corporate intranet.

The implementation of a computerized system that is updated in real time, accessible to all stakeholders providing their assistance, and increasing patient awareness of their vaccination status would simplify the real-time monitoring of vaccination coverage and enable targeted corrective

interventions. Additionally, such a system would facilitate the procedures for obtaining vaccination certification by patients. Ideally, vaccination status should be included in the electronic patient health file.

Discussion

As the SARS-CoV-2 pandemic has demonstrated, infectious diseases are still mistakenly underestimated as a cause of morbidity and mortality by the population, which is further affected by the observed low vaccine coverage in OAFs.

Literature suggests several effective interventions in increasing vaccine coverage among OAF, though most of the experiences do not refer to the Italian reality. The present survey contributed to partially fill this gap. A wide range of organization models and settings for immunization supply to OAFs were found across the involved Regions. The local implementation of the 27 interventions to increase vaccination coverage among OAFs suggested by literature ranges from 0% to 100%, with higher rates for interventions targeting the professional (e.g., audits), lower when aimed to increase vaccination offer (e.g., active calls) or accessibility (e.g., home vaccination).

It is not possible to identify a single and specific best practice for each individual context examined. Instead, during the interviews, a variety of approaches were identified that organizations chose to combine with each other, implementing them with specific adaptations based on the unique characteristics of each context. Consequently, seven good practices have been identified and described: mass vaccination centers; vaccination mobile units; drive-through vaccination; co-administration; tailored pathways; cooperation among providers involved in vaccination; digitization.

The mass vaccination centers, drive-through vaccination and mobile units showed high performance but required complex logistic organization involving multiple institutions. Therefore, it is desirable to have a vaccination plan that considers suitable locations and the necessary actions for their rapid activation in each reality (standardizing setup, organization, pathways, and protocols). According to our context, a vaccination team was able to administer 20/30 vaccination/hour, in line with general recommendations.²⁶ Drive-through vaccination shown successful in emergencies as reported by Banks et al. of 2,174 individuals vaccinated in 1,275 vehicles, with an average transit time of 5 minutes per vehicle, 48 seconds per vaccination, 200 vehicles/hour.²⁷

Mobile units, in addition, have proved useful to fight against vaccine hesitancy, involving people in opportunities of prevention and improving access to vaccination services.^{28,29}

If the abovementioned interventions are suitable to win “speed races” like pandemic response, the others four good practices will be more useful to cope with the “marathon” that the National Health Service is called to face daily to ensure a constant and homogeneous population coverage of the population.

In this regard, it is essential to develop innovative organizational ways to enhance citizen and territory support, collaborating with GPs, specialists and hospital vaccination centers.

Technical and scientific valuable documents are also essential, capable of promoting professionals training and homogenous behaviors adoption based on the best scientific evidence.^{30,31} All this, however, will not be possible without a rapid and integral impulse to computerize and digitalize vaccination registries to ensure vaccination coverage real-time updating and maximum interoperability of the vaccine information. Notably, most of these good practices have been listed as essential objectives in the current National Vaccination Plan.³²

It will be key to improve population education, to deal with the lack of knowledge around the issue of infectious diseases, their consequences and the benefit of vaccines in prevention. New awareness-raising strategies should be tested, developed and disseminated, taking into account patients’ preferences, levels of literacy, cultural background.³³ The presence of frailty and functional impairment, both physical and cognitive, might hinder the effective communication with patients, impact vaccine uptake and is eventually linked to a higher rate of vaccine hesitancy among the older population. Good practices aimed at increasing adherence to vaccination campaigns should take into consideration patients’ underlying functionality, by assessing their frailty and cognitive status. The routinary assessment of such dimensions in primary care is key. The ultimate goal would be to increase the vaccination rate among frail old individuals, who are notoriously those experiencing the worst infections’ outcomes.^{34,35}

Obvious consequence is an adequate communication strategy, well targeted to citizen and health professionals, as well as the strengthen of networks between professionals.³⁶ The website “VaccinarSi,” created in 2013 to perform information on vaccines to the general population and the health community, represents a good initiative in this sense.^{37,38}

This study has some limitations: only 9 out of 20 Italian Regions were involved in the survey, though they represent around half the population, a follow-up study on the remaining Regions would be desirable to have a more complete picture. Moreover our survey did not explore the domain of frailty and functional impairment. Specifically, how such aspects were taken into consideration by the surveyed health providers in relation to vaccination best practices. Some of the good practices identified are already known in the scientific literature, but this research has the merit to collect concrete Italian experiences, facilitating their diffusion at national and international level.

Furthermore, even if the interviews were conducted between January and March 2021, the results of our study are quite independent from the rapid evolution of the pandemic period. As a matter of fact, the recently published Italian National Vaccine Plan (august 2023) has stated many of the good practices highlighted in this research within the main goals of the three-year period 2023–2025 in order to increase adherence and thus vaccine coverage.

Conclusions

Literature highlights many effective interventions to improve immunization of OAFs, but their implementation at local level shows considerable heterogeneity. We described and identified seven good local practices: mass vaccination centers;

vaccination mobile units; drive-through vaccination; co-administration; tailored pathways; cooperation among providers involved in vaccination; digitization.

Providers should combine several interventions adequate to the specific context (organizational models, interoperability, urban/rural context, etc.) and share good practices. It is essential to take advantage of all the experience accumulated during the SARS-CoV-2 pandemic to promote the best vaccine prevention in all age groups, in accordance with the National Immunization Plan, with the aim to dispose of waiting lists and establish a virtuous mechanism for substantial and lasting improvement in vaccination coverage, even in the category that paid the highest price during the pandemic, such as the OAFs.

Acknowledgments

The Authors are grateful for their availability during the interviews at: Guglielmino Baitelli, Ester Chermaz, Aniello Esposito, Lorenza Ferrara, Rosa Prato, Maria Grazia Santini, Michele Tonon, Gennaro Volpe. The Authors are also grateful to the Italia Longeva staff: Andreina de Pascali, Lara Crocca and Cecilia Behmann, for their constant administrative support.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

Italia Longeva received an unrestricted grant from GSK and MSD to support this research

Author contributions

“Conceptualization, P.A., C.A.; methodology, P.A., V.D.L.; validation, C. A., F.D., B.R., I.G., Sid. A. and Sil.A.; formal analysis, P.A. and P.G.; investigation, P.A., S.A, A.C., C.D, C.C and CA.; data curation, P.A. and P.G.; writing – original draft preparation, P.G. and P.A.; writing – review and editing, V.D.L., C.A., C.C. and P.A.; supervision, P.A, V.D.L. and B.R. All authors have read and agreed to the published version of the manuscript.”

References

- Global Vaccine Action Plan. [accessed 2023 Aug 2]. <https://www.who.int/teams/immunization-vaccines-and-biologicals/strategies/global-vaccine-action-plan>.
- Liu Z, Liang Q, Ren Y, Guo C, Ge X, Wang L, Cheng Q, Luo P, Zhang Y, Han X. Immunosenescence: molecular mechanisms and diseases. *Sig Transduct Target Ther*. 2023;8(1). doi:10.1038/S41392-023-01451-2.
- Pawelec G. Age and immunity: what is “immunosenescence”? *Exp Gerontol*. 2018;105:4–9. doi:10.1016/J.EXGER.2017.10.024.
- Nikolich-Zugich J. The twilight of immunity: emerging concepts in aging of the Immune system. *Nat Immunol*. 2018;19(1):10–19. doi:10.1038/S41590-017-0006-X.
- Pawelec G. Immunosenescence Comes of Age. *Symposium on Aging Research in Immunology: The Impact of Genomics. EMBO reports* 2007; 8: 220–3, doi:10.1038/SJ.EMBOR.7400922.
- Vetrano DL, Triolo F, Maggi S, Malley R, Jackson TA, Poscia A, Bernabei R, Ferrucci L, Fratiglioni L. Fostering healthy aging: the interdependency of infections, immunity and frailty. *Ageing Res Rev*. 2021;69. doi:10.1016/J.ARR.2021.101351.
- Franceschi C, Campisi J. Chronic inflammation (inflammaging) and its potential contribution to age-associated diseases. *J Gerontol A Biol Sci Med Sci*. 2014;69(1):4–9. doi:10.1093/GERONA/GLU057.
- Baechele JJ, Chen N, Makhijani P, Winer S, Furman D, Winer DA. Chronic inflammation and the hallmarks of aging. *Mol Metab*. 2023;74:101755. doi:10.1016/J.MOLMET.2023.101755.
- Vetrano DL, Collamati A, Magnavita N, Sowa A, Topinkova E, Finne-Soveri H, van der Roest HG, Tobiasz-Adamczyk B, Giovannini S, Ricciardi W, et al. Health determinants and survival in nursing home residents in Europe: results from the SHELTER study. *Maturitas*. 2018;107:19–25. doi:10.1016/J.MATURITAS.2017.09.014.
- Esposito S, Principi N, Rezza G, Bonanni P, Gavazzi G, Beyer I, Sulzner M, Celentano LP, Prymula R, Rappagliosi A, et al. Vaccination of 50+ adults to promote healthy ageing in Europe: the way forward. *Vaccine*. 2018;36:5819–24. doi:10.1016/J.VACCINE.2018.08.041.
- Scognamiglio F, Fantini MP, Reno C, Montalti M, Di Valerio Z, Soldà G, Salussolia A, La Fauci G, Capodici A, Gori D. Vaccinations and healthy ageing: how to rise to the challenge following a life-course vaccination approach. *Vaccines*. 2022;10(3):375. doi:10.3390/VACCINES10030375.
- Poscia A, Collamati A, Carfi A, Topinkova E, Richter T, Denkinger M, Pastorino R, Landi F, Ricciardi W, Bernabei R, et al. Influenza and pneumococcal vaccination in older adults living in nursing home: a survival analysis on the shelter study. *Eur J Public Health*. 2017;27:1016–20. doi:10.1093/EURPUB/CKX150.
- Sheikh S, Biundo E, Courcier S, Damm O, Launay O, Maes E, Marcos C, Matthews S, Meijer C, Poscia A, et al. A report on the status of vaccination in Europe. *Vaccine*. 2018;36:4979–92. doi:10.1016/J.VACCINE.2018.06.044.
- MacDonald N, Mohsni E, Al-Mazrou Y, Kim Andrus J, Arora N, Elden S, Madrid MY, Martin R, Mahmoud Mustafa A, Rees H, et al. Global vaccine action plan lessons learned I: recommendations for the next decade. *Vaccine*. 2020;38(33):5364–71. doi:10.1016/j.vaccine.2020.05.003.
- Poscia A, Stojanovic J, Ricciardi W. The sustainability of influenza vaccination programs: considerations and perspectives from Italy. *J Prev Med Hyg*. 2016;57:E9.
- Health Care Use - Influenza Vaccination Rates - OECD Data. [accessed 2023 Aug 11]. <https://data.oecd.org/healthcare/influenza-vaccination-rates.htm>.
- Ministero della Salute. Impatto dell'emergenza COVID-19 sulle attività di vaccinazione – analisi del fenomeno e raccomandazioni operative. [accessed 2023 August 11]. <https://www.trovanorme.salute.gov.it/norme/renderNormsanPdf?anno=2020&codLeg=75346&parte=1/&serie=null>.
- Oliani F, Savoia A, Gallo G, Tiwana N, Letzgs M, Gentiloni F, Piatti A, Chiappa L, Bisesti A, Laquintana D, et al. Italy's rollout of COVID-19 vaccinations: the crucial contribution of the first experimental Mass vaccination site in Lombardy. *Vaccine*. 2022;40(10):1397–403. doi:10.1016/J.VACCINE.2022.01.059.
- Thomas RE, Lorenzetti DL. Interventions to increase influenza vaccination rates of those 60 years and older in the community. *Cochrane Db Syst Rev*. 2018;5. doi:10.1002/14651858.CD005188.PUB4.
- Antonelli Incalzi R, Bernabei R, Bonanni P, Conversano M, Ecartot F, Gabutti G, Maggi S, Paolini D, Sandri F. Vaccines in older age: moving from current practice to optimal coverage—a multidisciplinary consensus conference. *Ageing Clin Exp Res*. 2020;32(8):1405–15. doi:10.1007/S40520-020-01622-Z.
- Keeney S, Hasson F, McKenna HP. A critical review of the delphi technique as a research methodology for nursing. *Int J Nurs Stud*. 2001;38(2):195–200. doi:10.1016/S0020-7489(00)00044-4.
- DeJonckheere M, Vaughn LM. Semistructured interviewing in primary care research: a balance of relationship and Rigour. *Fam Med Com Health*. 2019;7(2):e000057. doi:10.1136/FMCH-2018-000057.

23. Italia Longeva | Associazione per l'invecchiamento e La Longevità Attiva. [accessed 2023 Aug 2]. <https://www.italialongeva.it/>.
24. The guide to community preventive services (The community guide). [accessed 2023 Aug 2]. <https://www.thecommunityguide.org/>.
25. Gallo G, Mel R, Ros E, Filia A. ISTITUTO SUPERIORE DI SANITÀ Guida Alle Controindicazioni Alle Vaccinazioni (Aggiornamento 2018).
26. SITI Decalogo per Il Piano Vaccinale Anti COVID-19. [accessed 2023 Aug 2]. https://www.vaccinarsi.org/assets/uploads/files/SITI_OIP_Decalogo_per_il_piano_vaccinale_anti_COVID_19.pdf.
27. Banks LL, Crandall C, Esquibel L. Throughput times for adults and children during two drive-through influenza vaccination clinics. *Disaster Med Public Health Prep.* 2013;7:175–81. doi:10.1017/DMP.2013.3.
28. Abdullah M, Ahmad T, Kazmi T, Sultan F, Afzal S, Safdar RM, Khan AA. Community engagement to increase vaccine uptake: quasi-experimental evidence from Islamabad and Rawalpindi, Pakistan. *PLoS One.* 2022;17(12):e0274718. doi:10.1371/JOURNAL.PONE.0274718.
29. Zeien J, Vieira J, Hanna J, Surendra L, Stenzel J, Ramirez A, Miller C, Rosales C. Mpox case reports in an urban homeless population and a proof of concept for a street-based mobile mpox vaccination clinic. *J Prim Care Community Health.* 2023;14. doi:10.1177/21501319231169991.
30. Bonanni P, Steffen R, Schelling J, Balaisyte-Jazone L, Posiuniene I, Zatoński M, Van Damme P. Vaccine Co-Administration in Adults: An effective way to improve vaccination coverage. *Hum Vaccin Immunother.* 2023;19(1):19. doi:10.1080/21645515.2023.2195786.
31. Poscia A, Ferro S, Tribuzi L, Spadea A. [Audit as a tool to improve the efficiency of the immunization services: the experience of a local health authority in Rome]. *Ig Sanita Pubbl.* 2017;73(5):507–21. <https://pubmed.ncbi.nlm.nih.gov/29433136/>.
32. Ministero della Salute. Piano nazionale della prevenzione vaccinale 2023-2025. [accessed 2023 Aug 2]. <https://www.trovanorme.salute.gov.it/norme/renderNormsanPdf?anno=2023&codLeg=95813&parte=1/&serie=null>.
33. Costantino C, Rizzo C, Rosselli R, Battista T, Conforto A, Cimino L, Poscia A, Fiacchini D. Ten Actions to counteract vaccine hesitancy suggested by the Italian society of hygiene, preventive medicine, and public health. *Vaccines.* 2022;10(7):1030. doi:10.3390/VACCINES10071030.
34. Xiong L, Han M, Wang C, Liu K, Liu T. Frailty is an Independent determinant of COVID-19 vaccine hesitancy in the elderly: a cross-sectional study. *Cell Mol Biol (Noisy-le-Grand).* 2022;68:202–7. doi:10.14715/cmb/2022.68.4.24.
35. Vetrano DL, Zucchelli A, Onder G, Fratiglioni L, Calderón-Larrañaga A, Marengoni A, Marconi E, Cricelli I, Lora Aprile P, Bernabei R, et al. Frailty detection among primary care older patients through the primary care frailty index (PC-FI). *Sci Rep.* 2023;13(1):3543. doi:10.1038/s41598-023-30350-3.
36. Silenzi A, Poscia A, Gualano MR, Parente P, Kheiraoui F, Favaretti C, Siliquini R, Ricciardi W. An effective clinical leadership to strengthen the immunization policies in Italy. *Ig Sanita Pubbl.* 2017;73(5): 483–96. [accessed 2023 Aug 2]. <https://pubmed.ncbi.nlm.nih.gov/29433134/>.
37. Bordin P, Melot B, Tralli V, Bertoni C, Moretti F, Siddu A, Baldo V, Bonanni P, Castiglia P, Majori S, Ferro, A, et al. Six years of activity of the Italian vaccine porta “VaccinarSi” : a web traffic evaluation using google analytics. *Ann Ig.* 2021;33(2):109–22. doi:10.7416/AI.2021.2417.
38. Arghittu A, Dettori M, Dempsey E, Deiana G, Angelini C, Bechini A, Bertoni C, Boccalini S, Bonanni P, Cinquetti S, et al. Health communication in COVID-19 era: experiences from the Italian VaccinarSi network websites. *Int J Environ Res Public Health.* 2021;18(11):5642. doi:10.3390/IJERPH18115642.