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### ► To cite this version:

A. Saade, B. Wyplosz, M. Baldeyrou, Christophe Paris, Pierre Tattevin, et al.. Infection prevention for immunocompromised patients: a cross-translational multicentric survey of current organization in France. *Infectious Diseases Now*, 2024, *Infectious Diseases Now*, 54 (2), pp.104863. 10.1016/j.idnow.2024.104863 . hal-04457944

**HAL Id: hal-04457944**

**<https://hal.science/hal-04457944v1>**

Submitted on 6 Jun 2024

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**Infection prevention for immunocompromised patients: a cross-translational multicentric survey of current organization in France**

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**Abstract**

*Objectives:* To evaluate current organization of infection prevention for immunocompromised patients (ICP) at a countrywide level.

*Methods.* Nationwide cross-sectional multicenter study based on an online survey disseminated in 2022.

*Results:* A total of 341 physicians (96% graduates, 32% infectious disease specialists), participated in the survey, with a median age of 40 [35-51] years. On-site access to infection prevention consultations for ICP was reported by 30%, dedicated pre-travel consultations for ICPs by 29%, consultations for infection prevention in solid organ transplant candidates by 16% and return-to-work consultations for ICPs by 6%. Most participants (73%) were aware of nationwide vaccination guidelines for ICP, while 50% felt comfortable using them. Tools for infection prevention advice and ICP vaccination had been developed by 10%, while 89% would have appreciated access to tools developed by others.

*Conclusions:* Infection prevention for ICPs remains neglected. Guidelines covering all fields of prevention for ICPs would be more than welcome.

**Keywords:** vaccination; immunocompromised; prevention; infectious risk

## Introduction

Infection risk assessment is the keystone of prevention for immunocompromised patients, leading to the implementation of preventive actions in daily life, at work, and/or in leisure-time activities [1]. While the number of patients with immunocompromised conditions increased by 16% from 2014 to 2018, data on infection prevention management in clinical practice are lacking. A recent population-based study reported low uptake of recommended vaccines in France in 2018, with vaccine coverage estimated at 19% and 35% for pneumococcus and influenza vaccines respectively [2]. Low vaccine coverage in France results from various factors including: 1) a paucity of training on vaccination during medical studies [3]; 2) the reluctance of organ specialists to propose vaccination to vulnerable patients [4,5]; 3) a lack of convenient access to vaccines ascribable to the absence of reimbursement in hospital settings; 4) a lack of electronic records on individual vaccination to help physicians communicate with one another; and 5) the absence of comprehensive guidelines covering all aspects of prevention in the immunocompromised host, with available recommendations dating back 10 years or more [6–10].

In routine practice, prevention in immunocompromised hosts is largely based on consultations of organ specialists, most of whom provide general advice and chemotherapeutic prophylaxis; infectious disease physicians who are experts on environmental exposure and vaccination; and occupational physicians who assess and attempt to attenuate hazards associated with occupational exposure.

To our knowledge, access to preventive health care for adults at risk of infections, which involves prevention consultations and coordination between physicians, has never been assessed. Hence, we conducted a cross-sectional nationwide study using an online questionnaire addressed to physicians contacted through medical societies, the objective being to explore the extent of preventive care for infectious diseases available to immunocompromised patients in France.

## Methods

We conducted a nationwide multicenter study based on an online survey sent to physicians through the French Infectious Disease Society network (Société de Pathologie Infectieuse de Langue Française, SPILF), and the National Network of Young Infectious Disease Physicians (Réseau des Jeunes Infectiologues Français, Réjif). In addition, the survey was disseminated through the mailing list of occupational physicians (mtph@crihan.fr) and MesVaccins.net, a website dedicated to information and education on vaccines, from April 28<sup>th</sup> through December 26<sup>th</sup> 2022.

In France, solid organ transplantation (SOT) is performed in accredited centers and during specialized occupational medicine consultations in regional occupational disease centers (RODC) specialized in diagnosis and follow-up of patients with work-related diseases (28 centers).

The questionnaire (**Supplementary data**) was divided into the following sections: 1) participant characteristics; 2) available facilities for immunocompromised patients at the

place of practice; 3) participant experience with immunocompromised patients; 4) on-site facilities for the vaccination of immunocompromised patients; 5) physician knowledge concerning French nationwide vaccination; [6] tools (booklets, leaflets, prefilled prescriptions, local guidelines, practical checklists, websites, other supports for prevention consultations) contributing to infection prevention in immunocompromised patients. Contact details of vaccination referents were obtained with the participants' consent. Descriptive analyses and geographical mapping were performed using R Studio®.

## Results

All in all, 341 physicians participated to the survey, predominantly (96%) graduated physicians, with a median age of 40 [35-51] years. Almost all (96%) were living in Metropolitan France, and the remaining 4% in overseas departments (11 from La Réunion Island and 1 from French Guiana). A majority were specialized in general medicine (35%) or infectious diseases (32%). They worked primarily in university hospitals (30%), non-university hospitals (28%), and private practice (24%) (**Table 1**).

Only 30% (n=104) of the participants reported on specifically targeted infection prevention consultations for immunocompromised patients existing in their settings, while 56% (n=190) did not have access to such consultations and 14% (47) said they did not know whether they existed, or did not answer the question (**Table 1**). The physicians stated that infection prevention consultations usually consisted in vaccination updates in 42% (44/104), safe living advice in 6% (6/104), and both in 47% (49/104). The actual role of these consultations was ignored by 5% of the respondents. Consultations for solid organ transplantation (SOT) candidates were reported by 16%, while travel advice consultations for immunocompromised patients (with or without a travel clinic) were reported by 29% (n=99). On the other hand, return-to-work consultations were reported by only 6% (n=21) (**Table 1**).

**Figure 1A** represents the geographical distribution of participating physicians covering 76% (n=73) of the 96 metropolitan departments (excluding overseas departments). In **Figure 1B**, the 40 (42%) departments where infection prevention consultations were reported are mapped in red. **Figure 1C** shows the distribution of the 26 accredited SOT centers. **Figure 1D** highlights the fact that 14 (54%) of them offer pre-transplant infection prevention consultations, as do in addition to 9 departments non-congruent with SOT center departments. Travel advice consultations for immunocompromised patients (**Figure 1E**) display distribution quite similar to infection prevention consultation distribution. **Figure 1F** shows that return-to-work consultations for immunocompromised patients were present in 17% (n=16) of departments. All respondents were close to a regional occupational disease center (RODC), as shown on Figure 1F.

Concerning vaccination, 27% (n=92) of participants reported that nurses were involved in vaccination of immunocompromised patients. Only 38% (n=129) physicians stated that a vaccination center existed at their workplace. According to 68% (n=231) of participants, vaccines were prescribed by the physician in charge of the immunocompromised patient, without his or her having received advice from an infectious disease specialist in their

establishment. Only 25% (n=85) of participants assess the vaccine coverage rate of their patients, either by self-declaration or through perusal of vaccination records (**Table 1**).

While most of the participants (n=248, 73%) were aware of the French vaccination guidelines for immunocompromised patients, only 50% (n=170) felt comfortable applying them, and 40% (n=137) attested to their routine implementation, and a mere 15% (n=52) reported the presence of a vaccination referent at their workplace. Tools to improve the management of infection prevention and vaccination for immunocompromised patients had been developed locally by 10% (n=35) of participants, while 89% (n=303) affirmed that they would appreciate having access to tools developed by others (**Table 1**).

## Discussion

This nationwide multicentric study included 341 physicians, most of whom were invested with preventive healthcare missions, representing 76% of the metropolitan departments in France. The main findings of this study are: First, only 30% of participants reported access in their establishments to infection prevention consultations for immunocompromised patients, 49% of which consisted in vaccination. Second, on-site travel advice consultations were reported by 29% of participants, consultations for SOT candidates by 16% and return-to-work consultations by only 6%. Geographic distribution of reported facilities for the immunocompromised largely overlapped with that of tertiary care centers. Strikingly, only 54% of SOT centers were reported to provide on-site access to pre-transplantation consultations dedicated to infection prevention. Lastly, this work underlines the fact that few physicians (n=10) had developed local tools to standardise their practices in the field, while 89% expressed a wish to have access to available tools, suggesting a need to foster exchange of these tools between the different actors.

Management of immunocompromised patients places a high burden on diagnosis and treatment of infectious complications, which is usually managed by organ specialists. Interventions upstream of infectious complications, most of which are avoidable by prevention and vaccination, are of utmost importance [11–13]. In the literature, however, prevention and vaccination appear sub-optimal, as reflected by low vaccination coverage in this population [2,14,15], which suggests that strategies to optimize prevention and vaccine uptake in immunocompromised patients remain insufficient. These observations are in line with the aforementioned offer in France of prevention consultations by infectious disease specialists. In fact, distribution of this offer overlaps with hospitals providing multidisciplinary consultations encompassing prevention, vaccination and travel advice. Return-to-work consultations are provided in RODCs (green dots on Figure 1F), but only a few respondents, located in 16 (17%) departments, were even aware of the existence of these centers. These data suggest a lack of occupational medicine coverage in France.

This work has limitations. Not all of the specialties involved in the management of immunocompromised patients (rheumatologists, neurologists, nephrologists and

hepatologists) were represented. Infection prevention consultations were not reported in all SOT centers, which may result from a participation bias. Alternatively, patients may be offered consultations in their department of origin prior to transplantation. Likewise, only 13 occupational physicians participated in the study, possibly entailing loss of information and underestimation of the actual offer of occupational disease consultations for immunocompromised patients.

Our study also has strengths. We primarily included infectiologists from tertiary care centers, who are closely involved in prevention and vaccination of immunocompromised patients, enabling accurate retrieval of the currently available main care facilities. In addition, this study generated a list of experts in vaccination of immunocompromised patients (**Supplementary Table 1**).

In conclusion, this study highlights a need for coordination between specialists and territories and, more generally, for improved provision of care to immunocompromised patients. The implementation of standardized infectious disease consultations including environmental and occupational safe living strategies as well as specific vaccination programs could optimize prevention of infections in immunocompromised patients. Other consultation techniques, provision of preventive care, national or international guidelines covering all fields of prevention (daily life, travel, and return-to-work advice; pharmaceutical and non-pharmaceutical prophylaxis; vaccination) in candidates for immunosuppression and immunocompromised hosts would be welcomed by the physicians caring for such patients. By communication and exchange, networks connecting expert physicians would promote standardization and optimization of infection prevention in immunocompromised patients. Last but not least, institution of an international task force to develop unique practical guidelines for prevention in immunocompromised patients would improve the effectiveness of preventive care in the population of concern. To ensure ownership by local players, these health policies will need to be adapted to local conditions.

### **Funding**

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

### **Ethics**

This study was carried out in accordance with the Declaration of Helsinki. Approval from the Rennes University Hospital Ethics Committee was obtained (CER Avis n°22.107). All participating physicians were given complete information on the study protocol and purposes. Written consent was obtained when filling out the questionnaire. Data were managed in accordance with General Data Protection Regulations (CNIL).

Journal Pre-proofs



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## **Acknowledgments**

We thank Jean-Louis Koeck for his help in publishing the questionnaire on the website MesVaccins.net. We also thank Christèle Cheneau for her help in coordination.

## **Author contributions**

**Anastasia Saade, Cécile Janssen and Marion Baldeyrou:** Conceptualization.

**Anastasia Saade and Cécile Janssen:** Methodology.

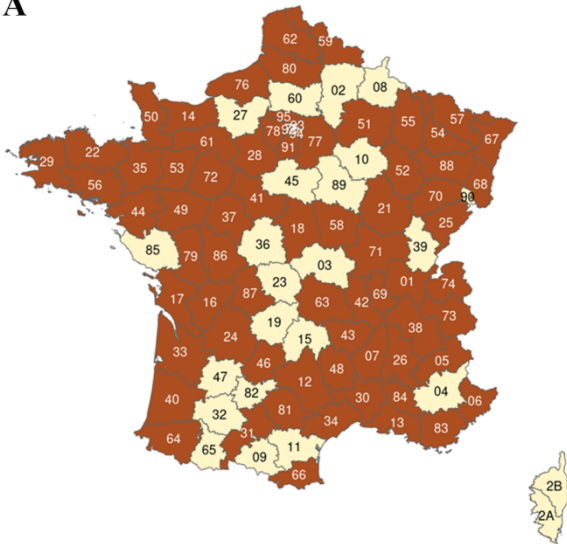
**Anastasia Saade, Benjamin Wyplosz and Pierre Tattevin :** Writing- Original draft preparation.

**Christophe Paris and Pierre Tattevin:** Supervision, Writing- Reviewing and Editing.

**Figure legend**

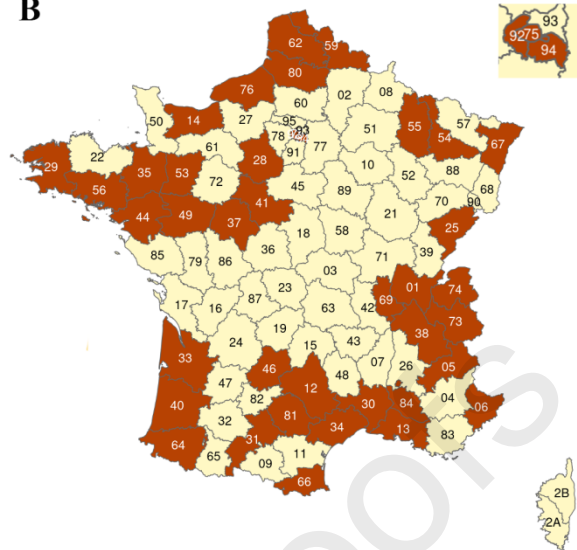
**Figure 1. Geographic distribution of access to infection prevention interventions for immunocompromised patients in France.** **A.** study participants (in red), **B.** infection prevention consultations dedicated to immunocompromised patients (in red), **C.** accredited solid organ transplant centers (in red), **D.** pre-transplant consultations dedicated to infection prevention for organ transplant candidates (in red), **E.** travel advice consultations for immunocompromised patients (in red) and **F.** return-to-work consultations for immunocompromised patients (in red) and regional occupational disease centers (RODC; green dots). Twenty-eight (28) occupational disease centers exist in France and are distributed among regions, with 3 RODCs located in Paris (department 75).

**A**



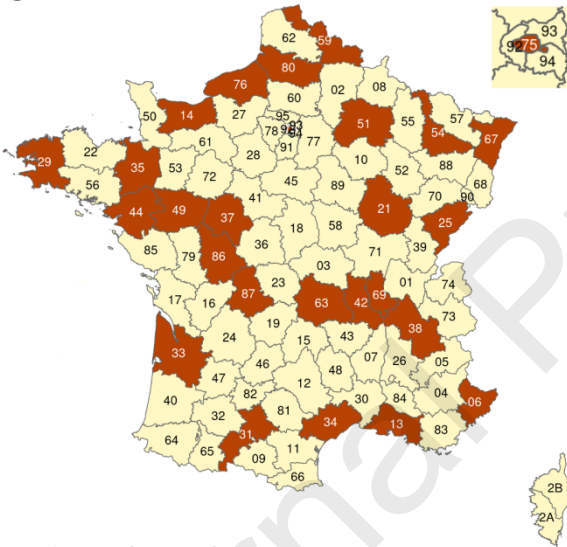
**Study participants**

**B**



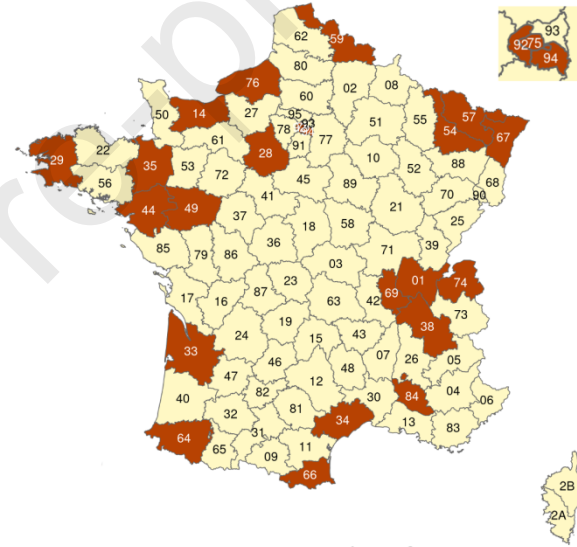
**Infection prevention consultations for immunocompromised patients**

**C**



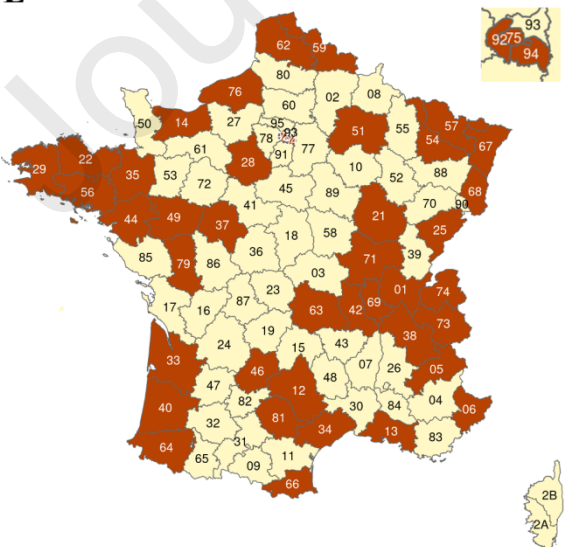
**Accredited solid organ transplant centers**

**D**



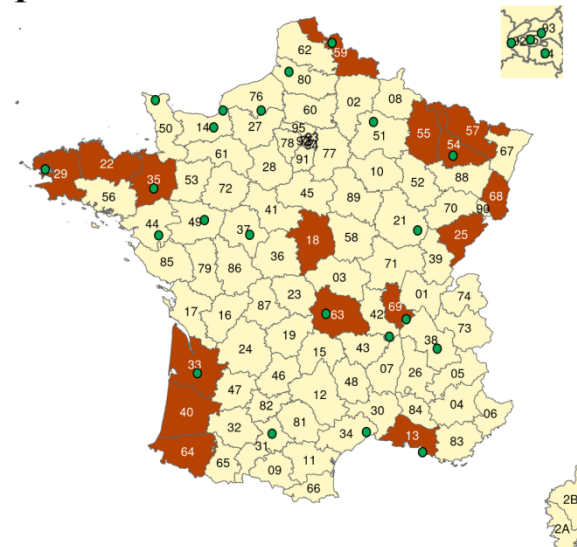
**Pre-transplant consultations for organ transplant candidates**

**E**



**Travel advice consultations for immunocompromised patients**

**F**



**Return-to-work consultations for immunocompromised patients**

Table 1. Description of the survey results

Participating physicians' characteristics	N (%)
Participants	341
Age (years), n [IQR]	40 [35 - 51]
Specialty, n (%)	
General medicine	119 (35)
Infectious diseases	109 (32)
Pneumology	19 (5)
Occupational medicine	13 (4)
Others	50 (15)
NA	31 (9)
Position	
Professor	16 (4)
Physician (private)	149 (44)
Physician (public)	139 (41)
Pharmacist	6 (2)
Fellow	23 (7)
Resident	8 (2)

## Type of workplace

University hospital	101 (30)
Non-university Hospital	96 (28)
Private practice	83 (24)
Public/private activity	16 (5)
Others	42 (12)
NA	3 (1)

## Available facilities for immunocompromised patients at the workplace

## Infection prevention consultations

Yes	104 (30)
No	190 (56)
I do not know	44 (13)
NA	3 (1)

## Role of infection prevention consultations (n=104)

Infection prevention without vaccination	6 (6)
Vaccination without infection prevention	44 (42)
Infection prevention and vaccination	49 (47)
I do not know	5 (5)

## Prescriber of vaccines for immunocompromised patients (multiple choices)

Physician in charge without infectious disease specialist advice	231(68)
Physician in charge with infectious disease specialist advice	140 (41)
Infectious disease specialist	146 (43)
General practitioner	121 (35)
Physician at a vaccination center	12 (4)
NA	4 (1)

## Pre-transplantation consultations

Yes	53 (16)
No	157 (46)
I do not know	128 (38)
NA	3 (1)

## Travel advice consultations

Yes	99 (29)
No	141 (41)
I do not know	100 (29)
NA	1 (0)

## Yellow fever vaccine for immunocompromised patients



	Yes	51 (15)
	No	279 (82)
	NA	11 (3)
Presence of a local vaccination expert		
	Yes	52 (15)
	No	236 (69)
	NA	53 (16)
Return-to-work consultations		
	Yes	21 (6)
	No	178 (52)
	I do not know	140 (41)
	NA	2 (1)
Involvement in the immunisation of immunocompromised patients		
Vaccination center		
	Yes	129 (38)
	No	183 (54)
	I do not know	26 (8)
	NA	3 (1)

## Nurse involved in vaccination (multiple choices)

Yes, at the workplace	21 (6)
Yes, in your wards	71 (21)
No	213 (62)
I do not know	22 (6)
NA	14 (4)

## Nurse involved in vaccination of immunocompromised patients

Yes	92 (27)
No	224 (66)
NA	25 (7)

## Awareness of nationwide vaccination guidelines

Yes	248 (73)
No	92 (27)
NA	1 (0)

## Confidence in vaccination guidelines

Yes	170 (50)
No	151 (44)
NA	20 (6)

## Guideline implementation in daily practice

Yes	137 (40)
No	51 (15)
I do not know	147 (43)
NA	6 (2)

## Helping others to the guidelines

Yes	86 (25)
No	240 (70)
NA	15 (5)

## Relations with other specialists

Yes	123 (36)
No	167 (49)
NA	51 (15)

## Evaluation of vaccine coverage

Yes	85 (25)
No	250 (73)
NA	6 (2)

## Development of tools for management of immunocompromised patients

Yes	35 (10)
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No	297 (87)
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NA	9 (3)
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Willing to share tools

Yes	67 (20)
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No	34 (10)
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NA	240 (70)
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Willing to obtain access to others' tools

Yes	303 (89)
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No	20 (6)
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NA	18 (5)
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Agree to be contacted as a vaccination expert

Yes	63 (18)
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No	265 (78)
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NA	13 (4)
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## Highlights

- In France, access to infection prevention advice for immunocompromised patients is suboptimal
- Only 30% of the physicians interviewed reported on-site access to dedicated consultations
- Most were aware of nationwide guidelines for vaccination of immunocompromised patients
- Guidelines covering all fields of infection prevention would be more than welcome

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