

# The journey of special population to vaccination centers in Brazil: knowledge and perceptions

**Tânia Cristina de Mattos Barros Petraglia**

Academia de Medicina do Estado do Rio de Janeiro

**Julia Regazzini Spinardi** (✉ [julia.spinardi@pfizer.com](mailto:julia.spinardi@pfizer.com))

Pfizer Inc <https://orcid.org/0000-0002-4324-0317>

**Rodrigo Sini de Almeida**

Pfizer Inc

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## Research article

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# Abstract

**Background:** Vaccination is one of the most effective public health strategies to control and prevent diseases. The Brazilian National Immunization Program is an international reference of public healthcare policy. Since 1993 Reference Centers for Special Immunobiologicals (CRIE) were implemented in order to facilitate the access to immunobiologicals, especially for those with congenital or acquired immunodeficiencies and other special morbidity conditions, or subjects exposed to risk situations. To assess knowledge and perceptions concerning the relevance of special patients' vaccination and the immunization centers (CRIE) structure from patients, physicians and CRIE professional perspectives.

**Methods:** An opinion survey was carried out in 2018 from June to July, including patients, physicians and CRIE professionals. A structured questionnaire was applied in a single interview to each interest group through phone calls. All instruments contained questions on general information, individuals' profile, and knowledge and perceptions concerning CRIE. Results were obtained from the compilation of each groups' answers. Data analysis was carried out in a descriptive approach, through measures of central tendency and dispersion for continuous variables, and measures of frequency for categorical variables.

**Results:** The sample was composed by 280 individuals: 135 physicians; 135 patients; and 10 CRIE professionals. Regarding physician's perspective, most of them reported to know CRIE (79%) and to refer patients (64%), and agreeing that a good quality service with well-trained professionals is offered (91%). Patients reported to receive the recommendation for vaccination by attending physician (91%), and to have never experienced the unavailability of a vaccine (91%) at CRIE. Analysis from CRIE professional's perspective showed that patients are most frequently referred to CRIE by infectologists (33%) and that vaccination campaigns have a huge influence on demand. However, they also reported that there is no disclosure about CRIE service for population and physicians.

**Conclusions:** Physicians classify vaccination as extremely important and all patients reported to follow recommendation. About immunization centers, a great perception about the service provided by CRIE was reported, but there is still place for uptake the patient journey.

## Background

The main purpose of vaccination is the control of infections transmission and diseases elimination individually and collectively. Children, adolescents and adults immunization should be a goal for doctors in their practice [1, 2]. In this scenario, vaccination programs must be consistent, promoting a broad coverage and prioritizing the high quality of epidemiological surveillance, aiming the maintenance of disease control measures [3].

Brazilian National Immunization Program is an international reference for public healthcare policy. The Brazilian government offers vaccines recommended by the World Health Organization free of charge universally. Since its creation in 1973, the program seeks social inclusion, serving throughout the national territory. Health facilities across the country provide vaccines present on the national vaccination

calendar, which covers all age groups and is in constant updating in order to incorporate new immunobiologicals or to adapt administration schemes to improve the program effectiveness [4].

Brazil's national vaccination calendar serves not only children but also adolescents, adults, the elderly, pregnant women and indigenous. In general, 19 vaccines are available in the immunization routine, from the neonatal period to the end of life [5].

The Ministry of Health gradually implemented the Reference Centers for Special Immunobiologicals (CRIE) throughout the Brazilian territory from 1993 to 2016. Each Federated Unit have at least one CRIE unit and there are currently 47 units located throughout the national territory [6]. CRIE's purpose is to facilitate population's access to special immunobiologicals, especially those with congenital or acquired immunodeficiencies and other special morbidity conditions, or subjects exposed to risk situations. Investigation, follow-up and elucidation of serious adverse events temporally associated with immunobiologicals administration is also a CRIE's responsibility [6].

A longer life expectancy and the access to new medicines result in a higher prevalence of chronic diseases with varying levels of immune impairment. This scenario creates a demand for immunization beyond official basic calendars, as recommended by international guidelines, preventing infections and its complications through vaccination [7, 8].

This study was conducted aiming to assess knowledge and perceptions concerning the relevance of special patients' vaccination and the immunization centers structure from patients, physicians and CRIE professionals' perspectives.

## Methods

### *Study design*

Data collection was performed using a quantitative approach, through from an opinion survey, in accordance with recommendations of the Brazilian Association of Research Companies. The study also comprised a qualitative approach, but only data from the quantitative phase are presented in this paper, carried out from June 8<sup>th</sup>/2018 to July 20<sup>th</sup>/2018. According with Resolution No. 510 from April 7<sup>th</sup>/2016 (Available from: <http://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf>), the registry and evaluation by an ethics committee is not necessary for public opinion surveys with unidentified subjects. Additionally, all participants signed an informed consent, after receiving information and agreeing with study procedures.

### *Sample selection*

Study sample was composed by patients, attending physicians and CRIE' professionals, all included according to specific eligibility criteria, from São Paulo, Rio de Janeiro, Porto Alegre, Salvador and Brasília. Physicians were personally interviewed at the clinic and randomly selected from different

sources (internet, database, recruitment companies), based on a filter questionnaire and quotas of specialties, diseases and cities. No filter for CRIE knowledge or referral were applied. Inclusion criteria were composed by: clinical practice in the management of patients with asplenia, nephropathy, solid transplant or bone marrow transplant, also called hematopoietic stem cell transplant, cancer, pneumopathy, diabetes mellitus, rheumatologic conditions, down syndrome or HIV; >3 years and <35 years of specialization in endocrinology, hematology, rheumatology, infectology, nephrology, oncology, pediatrics, or pneumology.

Patients were recruited at CRIE entrance or exit and included if presented asplenia, nephropathy, solid or hematopoietic stem cell transplant, cancer, pneumopathy, diabetes mellitus, rheumatologic conditions, down syndrome or HIV; vaccinated for at least 6 months at a CRIE; and followed by one clinical specialties of interest (endocrinology, hematology, rheumatology, infectology, nephrology, oncology, pediatrics, pneumology). CRIE professionals (physicians, nurses or healthcare professionals) with knowledge on the whole process of vaccines acquisition, stock control, patient records and registration of applied vaccines were included, selected by direct contacts at CRIE or by phone.

### *Study procedures*

A structured questionnaire developed for this study (available as a supplementary file) was applied in a single interview to each interest group through phone calls. All instruments contained questions on general information, individuals' profile, and knowledge and perceptions concerning CRIE. Results were obtained from the compilation of each groups' answers.

Physicians' questionnaire presented additional questions concerning perceptions on vaccination (referred diseases, reasons for patient's non-referral, referring moment, and its importance). CRIE section also asked about referral and recommendation, defined as direct patient referral to healthcare, or just advise them, respectively.

At patients' instrument, questions on diagnosis, comorbidities, visits to healthcare professionals, vaccination history and vaccines perception were also present. CRIE professionals' questionnaire carried specific questions such as patients' flow and profile, amount of vaccines provided, medical specialties referring to CRIE, attendance and decision-making process.

### *Statistical Analysis*

Data analysis was carried out in a descriptive approach, through measures of central tendency and dispersion for continuous variables, and measures of frequency for categorical variables. Microsoft Office 365 and SPSS were used.

The sample size was calculated considering a parameter estimation strategy and a 95% confidence interval. A margin of error of nine percentual points was used to calculate the sample needed for patients and physicians and six, for total sample. For CRIE professionals, margin of error was established through an indicative lecture.

## Results

The sample was composed by 280 individuals. Among physicians (N=135), infectologists (N=15), nephrologists/hematologists (N=45), oncologists/rheumatologists (N=15), pneumologists (N=30), endocrinologists (N=15), and geneticists/pediatricians (N=15) were included. A total of 135 patients were included with the following diagnosis: HIV (N=15), anatomical or functional asplenia and related diseases (N=15), chronic nephropathies/hemodialysis/nephrotic syndrome (N=15), transplantation of solid organs or hematopoietic stem cells (N=15), immunodeficiency due to cancer or immunodepression therapy (N=15), chronic pneumopathies/moderate and severe persistent asthma (N=15), diabetes mellitus (N=15), down syndrome (N=15) and cystic fibrosis (N=15). Ten CRIE professionals completed the analysis.

Table 1 presents characteristics of included physicians, composed by a majority of female (64%) with 15.1 years of mean specialty experience. Most physicians reported to work in private clinics (81%), public hospital/ambulatory (56%) and private hospital/ambulatory (50%). Monthly, the mean amount of 268 patients are attended by professionals.

**Table 1. Characteristics of physicians in the quantitative analysis.**

<b>Variables</b>	<b>N</b>	<b>%</b>
<b>Location</b>		
São Paulo	54	40
Rio de Janeiro	18	13
Belo Horizonte	18	13
Salvador	18	13
Porto Alegre	18	13
Brasília, Distrito Federal	9	7
<b>Gender</b>		
Male	49	36
Female	86	64
<b>Main specialty</b>		
Pneumologist	25	19
Hematologist	22	16
Oncologist	21	16
Infectologist	15	11
Endocrinologist	15	11
Pediatrician	13	10
Nephrologist	9	7
Hepathologist	5	4
Rheumatologist	3	2
Pneumo-pediatrician	3	2
Geneticist	2	2
Immunologist	2	2
Length of specialty practice, mean		15.1
<b>Other specialty</b>		
General practice	45	33
Pediatrician	7	5
Bone marrow transplantation	5	4
Allergy and immunology	4	3
Work medicine	2	2
Intensive medicine	2	2
Gastroenterologist	2	2
Other	23	16
None	50	37
<b>Workplace</b>		
Private clinic	109	81
Public hospital/ambulatory	76	56
Private hospital/ambulatory	67	50
Reference center/public school hospital	31	23
University	12	9
Multiplicity index	2.2	2.2
<b>Length of stay in each workplace, mean %</b>		
Private clinic		44
Public hospital/ambulatory		24
Private hospital/ambulatory		21
Reference center/public school hospital		9
University		3
Patients attended per month, mean		268
<b>Treated diseases</b>		
Immunodeficiency due to cancer or immunodepression therapy	76	56
Diabetes mellitus	65	48
Chronic pneumopathies	54	40

Transplantation	53	39
HIV	43	32
Chronic nephropathies/hemodialysis/nephrotic syndrome	37	27
Spleen disease/functional or anatomical asplenia	30	22
Cystic fibrosis	24	18
Down syndrome	22	16
Multiplicity index	3.0	3.0

Regarding physicians' perceptions on vaccination, most of them classify it as extremely important (85%) and introduces the subject up to the third appointment (48% in the first appointment and 43% on second and third appointments). Considering the referral process, most cases are referred to a public healthcare center (84%) and only 62% to CRIE (Table 2).

**Table 2. Perceptions on vaccination importance and referral pattern by physicians included in the quantitative analysis.**

Variables	N	%
General vaccination importance		
Extremely important (5)	115	85
(4)	19	14
(3)	1	1
(2)	-	-
Nothing important (1)	-	-
Introduction of vaccination subject		
In the first appointment	65	48
In second-third appointment	58	43
In fourth-fifth appointment	9	7
In the sixth appointment or latter	2	2
Did not answer	1	1
Locations that routinely refer patients		
Public healthcare center	113	84
Private clinical/laboratory	88	65
CRIE	84	62
Percentage of patients that usually refers, mean %		
To a public healthcare center		54
To a private clinical/laboratory		46
To a CRIE		46
Vaccination, mean %		
Patients who effectively vaccinate after recommendation	78	78

CRIE: Reference Centers for Special Immunobiologicals.

Physicians' perceptions on CRIE are presented in Table 3. Most reported to know CRIE (79%), frequently from a professor in Medical School (19%). The majority of the physicians reports currently referring patients (64%). Those not referring justify the use of a private service by patients (39%) as an explanation. Referring process is most frequently written (84%) and physicians considers the process as a little bureaucratic (78%).

Most of them agreed that CRIE offers a good quality service, with well-trained professionals (91%), offering other healthcare services beyond vaccines (51%). Furthermore, most of them disagree that:

vaccines offered on private services are better (73%); CRIE have problems in installations compromising products conservation (56%); there is no lack of products (51%); and CRIE are public places that serve only the low-income population (93%).

**Table 3. Physicians perceptions on CRIE.**

Variables	N	%
Knows the CRIE		
Yes	107	79
No	28	21
Knew about CRIE		
Through a professor in Medical School	25	19
Medical residency in a place with a CRIE	24	18
Through a colleague	23	17
Worked in a location with CRIE or that referred to CRIE	16	12
Communication from Ministry of Health	13	10
Hospital information	2	2
Other	4	4
Relationship with CRIE		
Heard about, but never recommended/referred patients	7	7
Recommended but not currently	10	9
Referred but not currently	4	4
Recommends patients currently	18	17
Refers patients currently	68	64
Reasons to not recommend/refer		
Patients access to private service	9	39
Prefers a Basic Unit Health Center (distance, vaccines availability)	6	29
Forgetfulness, rush, lack of time	5	24
Lack of knowledge	1	5
Vaccines are unavailable on public healthcare	1	5
Leave it to the patient's decision	1	5
Does not know	1	5
Multiplicity index	1.1	1.1
<i>Opinion/Knowledge about CRIE</i>		
Offers quality service with well trained professionals		
Disagree	-	-
Does not agree or disagree	7	7
Agree	97	91
Does not know/answer	3	3
In addition to vaccination, also offers other health services		
Disagree	16	15
Does not agree or disagree	17	16
Agree	54	51
Does not know/answer	20	19
Vaccines offered on private services are better than those offered in CRIE		
Disagree	78	73
Does not agree or disagree	16	15
Agree	11	10
Does not know/answer	2	2
They have problems in installations compromising the conservation of the products		
Disagree	60	56
Does not agree or disagree	19	18
Agree	10	9
Does not know/answer	18	17
There is no lack of products		
Disagree	55	51
Does not agree or disagree	31	29
Agree	10	9
Does not know/answer	11	10

CRIE serves only the low-income population		
Disagree	99	93
Does not agree or disagree	4	4
Agree	2	2
Does not know/answer	2	2
<hr/>		
<i>Referring process</i>		
<hr/>		
How is the referring process		
Most verbal	7	8
Most written	72	84
Balanced between verbal and written	7	8
Opinion about referring process		
Reasonably bureaucratic	14	16
Little bureaucratic	67	78
Very bureaucratic	5	6
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CRIE: Reference Centers for Special Immunobiologicals.

Results from patients' quantitative analysis are presented in Table 4. Most of vaccinations (96%), access to medications (81%), and medical appointments (80%) were provided by the Brazilian Public Healthcare System (SUS). Regarding vaccination, most patients receive recommendation by the attending physician (91%), frequently after a three months follow-up period (36%). Considering the experience at CRIE, most patients reported to have never experienced the unavailability of a vaccine (91%).

**Table 4. Characteristics according to healthcare provider, vaccination and perceptions about reference centers for special immunobiologicals, from patients' perspective in the quantitative analysis.**

<b>Variables</b>	<b>N</b>	<b>%</b>
<i>Type of healthcare provider</i>		
Vaccination		
SUS	134	96
Health insurance	2	1
Private	4	3
Access to medication		
SUS	109	81
Health insurance	7	5
Private	19	14
Medical appointments		
SUS	108	80
Health insurance	21	16
Private	6	4
<i>Recommendation for vaccination</i>		
Introduction of vaccination subject		
In the same month	45	33
Two months later	11	8
Three months later	10	7
After three months	48	36
No answer	21	16
Professional responsible for the recommendation		
Attending physician	123	91
Physician from public healthcare center	7	5
Other specialists	2	2
Other ways	3	3
Reaction to the recommendation		
Not afraid	95	70
Afraid, but received the vaccine	40	30
Recommendation for vaccination of close relatives		
Yes	20	15
No	114	84
No answer	1	1
Request for vaccine recommendation		
Yes	9	7
Flu	3	33
Pneumonia	3	33
Tetanus	1	11
Yellow fever	1	11
Tuberculosis	1	11
Meningitis	1	11
No	126	93
<i>Accomplishment of vaccination</i>		
Vaccines received in private laboratories / clinics		
Influenza	2	40
Varicella zoster	2	40
Meningococcal B	1	20
Multiplicity index	1.0	1.0
Unavailability of the vaccine in the CRIE		
Yes	11	8
Once	7	5
Twice	3	2
Three times	1	1

No	123	91
No answer	1	1

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CRIE: Reference Centers for Special Immunobiologicals; SUS: Brazilian Public Healthcare System.

Table 5 shows CRIE professionals' characteristics and their perceptions about CRIE. Analysis from CRIE professionals' perspective have shown that patients are most frequently referred to CRIE by infectologists (33%), pediatricians (19%), nephrologists (11%) and rheumatologists (11%). Vaccination campaigns have a huge influence on demand, especially for influenza. Main provided vaccines were influenza (19%), pneumococcal 23 (15%), meningococcal conjugate group C (13%) and hepatitis B (14%), representing 61% of the total. CRIE professionals also reported that about 80% of CRIE attendance is intended for vaccines to patients with chronic diseases. However, there is no disclosure about CRIE service for population and physicians.

Regarding the satisfaction related to provided service, CRIE professionals most frequently classify as great (60%) the attention of the nurse when checking the vaccine and as good (40%) the politeness and cordiality of employees. Regarding length of service from arrival to departure and time spent between submitting documentation and vaccination assessment, CRIE professionals' opinions are divided between needs to improve a little (30%), good (30%) and great (30%) – (Table 5).

**Table 5. Characteristics and perceptions about reference centers for special immunobiologicals from CRIE professional's perspective in quantitative analysis.**

Variables	N	%
Percentage of patients referred by each specialty, mean %		
Infectologist	-	33
Pediatrician	-	19
Nephrologist	-	11
Rheumatologist	-	11
Hematologist	-	10
Pneumologist	-	10
Oncologist	-	10
Hepathologist	-	7
Pneumo-pediatrician	-	6
Endocrinologist	-	5
Immunologist	-	2
Geneticist	-	0
Other	-	0
Patients have the possibility of attendance in another CRIE		
Yes	9	90
No	1	10
Influence of campaigns on the demand for vaccination		
Yes	10	100
Influenza	10	100
Yellow fever	2	20
Pneumococcal 23	1	10
Update of vaccine cards	1	10
Multiplicity index	1.5	1.5
Percentage of vaccines provided, mean %		
Influenza	-	19
Pneumococcal 23	-	15
Meningococcal conjugate group C	-	13
Hepatitis B	-	14
DTP acellular	-	7
Hepatitis A	-	7
Hib	-	6
Tetanus	-	4
Varicella	-	5
Inactivated poliovirus (Salk)	-	2
Pentavalent	-	2
Rabies	-	1
Other	-	4
<i>Satisfaction with the service provided</i>		
Attention of the nurse when checking the vaccine		
Needs to improve	0	-
Good	3	30
Great	6	60
No answer	1	10
Length of service from arrival to departure		
Needs to improve	4	40
Good	3	30
Great	3	30
No answer	0	-
Education and cordiality of employees		
Needs to improve	3	30
Good	4	40

Great	3	30
No answer	0	-
Time between submitting documentation and vaccination		
Needs to improve	4	40
Good	3	30
Great	3	30
No answer	0	-

CRIE: Reference Centers for Special Immunobiologicals.

## Discussion

Data presented in this survey show the perception about vaccination relevance and immunization centers from three different perspectives: physicians specialized in the treatment of risk patients; patients with risk comorbidities; and immunization center professionals.

A high percentage of physicians (85%) have considered immunization as extremely important and reported to mention this subject with patients in first medical appointments. However, rates of vaccine coverage among special patients are still considered low in Brazil. Only 62% of physicians included in the sample reported to refer patients specifically to a CRIE instead of a basic health unit, which may explain the low vaccination coverage. CRIE is the unique center to offer all the vaccines required in the calendar for risk patients, at a public health level. Thus, by referring to the basic health unit, patients could face limitations in access to all vaccines offered by the National Immunization Program for their clinical condition [4, 6].

Previous Brazilian studies have assessed vaccine coverage among people living with HIV/AIDS from cities of different regions. Percentages of patients with a vaccination card classified as complete regarding the proposed calendar at the time of the study were 16.7% and 14% in São Paulo and Fortaleza, respectively [9, 10]. In another study assessing the same patient profile followed by a specialized healthcare center from Espírito Santo, 20% have never received a vaccine [11].

The influence of referring patients to a basic health unit could be observed in the analysis of people living with HIV/AIDS cohorts from Ceará and Espírito Santo. Vaccines available at these units, such as influenza, diphtheria and tetanus, have shown a greater uptake when compared to those available only at CRIE, such as pneumococcal [10, 11].

On the other hand, some concerns regarding vaccination in risk patients in basic health units must be explored. A study involving patients undergoing hematopoietic stem cell transplant from the interior of São Paulo have shown delay or not performing the vaccination schedule when patients were directly referred to a basic health unit instead of a CRIE. Professionals working in basic health units does not follow the same CRIE guidelines, and usually cannot access special vaccines or even deal with adverse events. The most frequently observed problem (about 40%) was lack of staff training in these units, and poor organization [12]. Lack of professional training from basic health units was also reported as a possible gap by another study assessing vaccination status of more than 700 diabetic patients from

Ribeirão Preto treated in a specialized service and followed in a basic health unit, where full-coverage of hepatitis B vaccine was reported as only 13.7% [13].

A study conducted with rheumatological patients from Brasília showed that only 7% the sample received orientation regarding vaccination from the specialist, however, 47% have inadvertently received a live component vaccine while using immunosuppressant therapy [14]. The lack of recommendation by health providers was also indicated as a reason for people living with HIV/AIDS low adherence to vaccination, in another study from Ceará [10].

Data reported on the present study show that the service offered by CRIE, as well as training of its employees, were classified as good in terms of quality by 91% of the interviewed physicians, even though they reported the process as a little bureaucratic. CRIE professionals also classified the performance of their teams as great (60%), despite a need for improvement being reported by 30% of interviewees. Regarding patients' perspective, service was also classified as positive and 91% of respondents have never experienced lack of vaccines during their visit to a CRIE.

Data regarding patients' perspective needs to be highlighted. The involvement of a specialist physician is reported as a decision factor for vaccine recommendation by 91% of the interviewed patients. Although 30% of the patients reported fear of being vaccinated, 100% of adherence was observed in the studied sample. The relevance of a specialized physician in the recommendation and in patients' adherence to vaccination schedule was previously reported by other authors and is indicated on guidelines [15, 16].

The frequency of visits to specialists by this patient profile is higher, increasing opportunities for immunization. Thus, specialists have an important influence in recommending and providing specific orientation to each patients' clinical condition [16]. A multidisciplinary team at sites receiving risk patients may help disseminate updated information on vaccination schedule [12].

Specialist physicians and CRIE members also have the responsibility to promote vaccination of risk patients' cohabitants. Recommendation is based on the need for creating a herd immunity around immunocompromised patients mainly to reduce the exposure to vaccine preventable diseases [6, 16]. Nevertheless, data reported in the present study showed that 84% of interviewed patients deny receiving that recommendation. Another noteworthy point is that specialists most compromised with the vaccination of patients with comorbidities are those who more often know CRIE and patients' adherence to vaccination is higher when referred by these professionals.

## Conclusion

Results reported in the present study corroborates the hypothesis that in order to increase vaccination coverage in a population most vulnerable to vaccine-preventable infections, it is important to improve communication between professionals involved in the care of patients with chronic and immunocompromising diseases, besides the improvement of knowledge about vaccines. An efficient communication and confidence become important to improve patients' adherence to vaccination. This

should include also a better educational activity and communication in basic health units and CRIE to amplify vaccination opportunities.

Perceptions on vaccination relevance was reported from the perspective of physicians, patients and CRIE professionals. Most of the physicians classify the procedure as extremely important and all patients reported to follow recommendation even if they were afraid. Regarding perceptions on immunization centers, patients, physicians and CRIE professionals reported to have a positive rating about the service provided by CRIE. Even though professional's knowledge regarding CRIE, the scarcity of information on vaccines could be described as a barrier to an appropriate referral of patients with chronic diseases. Furthermore, despite the excellent evaluation of CRIE, opportunities on vaccination referral of patients and their cohabitants are missed by professionals.

## **Abbreviations**

CRIE: Reference Centers for Special Immunobiologicals; SUS: Brazilian Public Healthcare System; HIV: human immunodeficiency virus; AIDS: acquired immunodeficiency syndrome.

## **Declarations**

### ***Ethics approval and consent to participate***

According with Resolution No. 510 from April 7<sup>th</sup>/2016 (Available from: <http://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf>), the registry and evaluation by an ethics committee is not necessary for public opinion surveys with unidentified subjects. Additionally, all participants signed an informed consent, after receiving information and agreeing with study procedures.

### ***Consent for publication***

Not applicable.

### ***Availability of data and material***

Data is available upon reasonable request and with permission of Ipsos Healthcare and Pfizer. The supplementary data available was made original in Portuguese and translated into English to accomplish the periodic publication rules.

### ***Competing interests***

TCMBP received a Pfizer grant as a consultant during the development of this manuscript. JRS and RSA are formal employees at Pfizer. The study was commissioned by Pfizer from IPSOS.

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### ***Authors' contributions***

TCMBP contributed to the interpretation and discussion of the results and contributed to the final version of the manuscript. JRS conceived the original idea and developed the theoretical framework, contributed to the interpretation and discussion of the results and contributed to the final version of the manuscript. RSA contributed to the interpretation and discussion of the results and contributed to the final version of the manuscript. All authors have read and approved the manuscript.

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Ipsos Healthcare, Patient Journey Prevenir – CRIE (Reference Centers for Special Immunobiologicals), is an opinion survey commissioned by Pfizer to Ipsos. Data collection happened in Brazil from 08/06/2018 to 20/07/2018 through face-to-face or phone interviews with patients who suffer from asplenia, nephropathy, solid or bone marrow transplant, cancer, pneumopathy, diabetes mellitus, rheumatologic conditions, down syndrome or HIV and were vaccinated for at least 6 months at a CRIE - visitors approached at CRIE's entrance or exit-, physicians and CRIE's professionals - personal interviews in their offices. The sample composed by 280 individuals - 135 physicians, 135 patients and 10 CRIE's professionals – has a 95% confidence interval.

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