

# Assessment of Knowledge, Practices, and Needs Regarding Positron Emission Tomography (PET) in Senegal

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## Abstract

Positron Emission Tomography (PET) is an advanced nuclear medicine imaging modality that plays a crucial role in the diagnosis and follow-up of oncological, neurological, and cardiovascular diseases. In Senegal, the absence of PET infrastructure restricts access to molecular imaging and limits the integration of this technology into clinical practice. To better understand the needs and potential for PET implementation, this study assessed the knowledge, potential uses, and expectations of Senegalese healthcare professionals. A cross-sectional survey was conducted among 120 practitioners across Senegal using a structured questionnaire addressing their knowledge, practices, and perceptions. Descriptive statistical analyses were performed to identify major trends. The study population was predominantly male (74%), with a sex ratio of 2.9. It consisted mainly of physicians (65.8%) and pharmacists (30.8%). Most respondents were familiar with the principles of PET and the role of radiotracers (82.5%), with [<sup>18</sup>F]-fluorodeoxyglucose (FDG) being the most frequently cited (45.8%). Only 11.7% had previously been prescribed PET scans. Interest in PET was particularly high in oncology, especially for the management of digestive (54.2%), pulmonary (49.2%), and urological (47.5%)

cancers. Although major barriers such as the lack of infrastructure and the high cost of examinations were identified, the Dakar region was considered the most suitable location for establishing a national radiotracer production facility and PET center. These findings highlight a strong interest and structured demand for PET imaging in Senegal. Establishing a national radiotracer production center and training qualified professionals are key steps toward introducing this technology. Female participation in the field could be enhanced through awareness and training initiatives in nuclear medicine.

## Keywords

Nuclear Medicine, Molecular Imaging, Positron Emission Tomography (PET), Radiotracers

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## 1. Introduction

Positron Emission Tomography (PET) is an advanced medical imaging technique that has become essential for the diagnosis and follow-up of numerous pathologies, particularly cancers, as well as certain neurological and cardiovascular disorders. It relies on the administration of radiotracers, which are biologically active molecules labeled with positron-emitting radioisotopes such as fluorine-18 or carbon-11. These radiotracers allow the generation of high-resolution functional images that provide information complementary to conventional morphological imaging [1].

Because of their short half-lives [2], radiotracers must be produced close to imaging centers. This requires specialized infrastructure, including cyclotrons and radiopharmacy laboratories.

In many African countries, the development of PET is limited by financial, logistical, and regulatory constraints [3] [4]. In Senegal, the current absence of a PET center and a radiotracer production unit represents a major barrier to access to this technology, despite increasing diagnostic needs, particularly in oncology.

To document these needs and provide a basis for establishing a PET center and a radiotracer production facility, we conducted a survey among Senegalese healthcare professionals. The objective of this study was to assess their knowledge, practices, and needs related to PET imaging, in order to identify clinical and organizational priorities for its introduction.

## 2. Methodology

This was a descriptive cross-sectional study conducted from August 19 to September 30, 2025, involving healthcare professionals working in public and private healthcare facilities in Senegal.

The survey was conducted on a voluntary basis using an online questionnaire distributed electronically through professional emails, scientific groups, and medical committees of healthcare institutions. Participants were recruited using a con-

venience sampling approach, complemented by snowball sampling.

The parameters analyzed included:

- Sociodemographic and professional characteristics
- Knowledge related to Positron Emission Tomography
- Current practices (prescriptions, known indications, barriers)
- Needs and expectations regarding the development of a PET center in Senegal

These parameters were used to design a structured survey consisting of 26 questions (closed, semi-open, and open-ended) organized into five sections: general information about the respondent, knowledge of PET, PET scan requests, radio-tracer supply, and human resources and competencies. The questionnaire was administered online via Microsoft Forms.

Collected data were exported to a spreadsheet and analyzed using a descriptive approach. Quantitative variables were expressed as means and ranges, while qualitative variables were presented as counts and percentages. Textual data from open-ended questions were analyzed using content analysis with Microsoft Excel.

### 3. Results

#### 3.1. Sociodemographic Characteristics of the Surveyed Healthcare Professionals

A total of 120 healthcare professionals practicing in Senegal participated in the study. The main sociodemographic characteristics are presented in **Table 1**. The study population was predominantly male, with 74% men and 26% women, corresponding to a sex ratio of 2.9. The mean age of participants was 35.9 years. The most represented age group was over 30 years (68%), while 32% of respondents were 30 years old or younger.

Geographically, the majority of participants were based in the Dakar region (66.7%), the main hospital-university and medical-technical hub of the country. Thiès (11.7%) and Ziguinchor (5%) were the second and third most represented regions, respectively. Lower participation was noted in Diourbel (5.8%), Saint-Louis (4.2%), Kaolack (3.3%), Kaffrine (0.8%), Fatick (0.8%), Matam (0.8%), and Kolda (0.8%). No responses were received from the regions of Kédougou, Louga, and Sédhiou.

Regarding professional status, 49.2% of respondents were medical doctors, 18.3% pharmacists, and 2.5% medical physicists. The remaining participants belonged to various healthcare professional categories, including biologists, radiologists, specialized nurses, and senior technicians.

The sample displayed a notable diversity of medical (65.8%) and pharmaceutical (30.8%) specialties (**Table 2**). The most represented specialties were hospital pharmacy (15%), radiology (11.7%), surgery (10.8%), medical biology (10.8%), oncology (6.7%), nuclear medicine (4.2%), and cardiology (4.2%). Radiopharmacists accounted for 4.2% of respondents, while other specialties (anesthesiology and intensive care, internal medicine, pediatrics, etc.) were present in smaller proportions.

### 3.2. Knowledge of Senegalese Healthcare Professionals on PET Imaging

The assessment of general knowledge about positron emission tomography (PET)

**Table 1.** Sociodemographic characteristics of surveyed healthcare professionals (N = 120).

Characteristic	Frequency	Percentage
<b>Sex</b>		
Male	89	74%
Female	31	26%
<b>Age group</b>		
≤30 years	38	32%
>30 years	82	68%
<b>Professional status/Grade</b>		
PhD in Biology	1	0.8%
Medical Doctor	59	49.2%
Doctor of Pharmacy	22	18.3%
Resident (DES student)	9	7.5%
Medical Student	2	1.7%
Nurse	3	2.5%
Medical Physicist	3	2.5%
Professor of Medicine	9	7.5%
Professor of Pharmacy	5	4.2%
Senior Technician in Applied Biology	7	5.8%
<b>Region/Location</b>		
Dakar	80	66.7%
Diourbel	7	5.8%
Fatick	1	0.8%
Kaffrine	1	0.8%
Kaolack	4	3.3%
Kédougou	0	0%
Kolda	1	0.8%
Louga	0	0%
Matam	1	0.8%
Saint-Louis	5	4.2%
Sédhiou	0	0%
Tambacounda	0	0%
Thiès	14	11.7%
Ziguinchor	6	5%

**Table 2.** Responses by specialty.

Training	Specialty Medical	Frequency	Percentage
<b>Medicine</b>	Cardiology	5	4.2%
	Nuclear Medicine	5	4.2%
	Oncology	8	6.7%
	Radiology	14	11.7%
	Neurologie	4	3.3%
	Other	22	18.3%
	<b>Surgical</b>		
	Urology	4	3.3%
	Surgery	13	10.8%
	Obstetrics and Gynecology	4	3.3%
<b>Pharmacy</b>	Medical Biology	13	10.8%
	Hospital Pharmacy	18	15%
	Radiopharmacy	5	4.2%
	Immunology	1	0.8%
<b>Nursing</b>	Nursing care	2	1.7%
<b>Physics</b>	Medical Physics	2	1.7%

revealed that 39.2% of participants achieved a perfect score (100% correct answers), whereas 60.8% demonstrated insufficient knowledge or were unable to define PET (**Table 3**).

**Table 3.** Level of knowledge and training of healthcare professionals on PET.

Variables	Frequency	Percentage
<b>Knowledge score on PET (out of 4)</b>		
0	3	2.5%
1	13	10.8%
2	26	21.7%
3	31	25.8%
4	47	39.2%
<b>Self-assessed level of knowledge on PET</b>		
None	13	10.8%
Poor	47	39.2%
Average	36	30.0%
Good	19	15.8%
Very good	5	4.2%

**Continued****Participation in PET-related training or information sessions**

No	63	52.5%
No, but interested	33	27.5%
Yes	24	20.0%

Regarding self-assessment of PET knowledge, 4.2% of respondents reported having a very good level, 15.8% a good level, 30% an average level, 39.2% a poor level, and 10.8% declared having no knowledge at all in this field.

In addition, only 20% of healthcare professionals had previously received training or attended an information session on PET.

**3.3. Uses of PET**

Among the 120 healthcare professionals surveyed, only 11.7% reported prescribing positron emission tomography (PET) examinations, whereas 88.3% did not prescribe them at the time of the survey (**Table 4**).

**Table 4.** Prescription of PET examinations by healthcare professionals: distribution, frequency, and target pathologies.

<b>Variables</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Distribution of healthcare professionals prescribing PET examinations</b>		
No	106	88.3%
Yes	14	11.7%
<b>Frequency of prescriptions</b>		
0	2	1.7%
Less than 5	15	12.5%
5 - 10	1	0.8%
11 - 20	1	0.8%
More than 20	1	0.8%
Not applicable	100	83.3%
<b>Identification of relevant target pathologies for PET</b>		
Digestive cancers	65	54.2%
Pulmonary cancers	59	49.2%
Urological cancers	57	47.5%
Lymphomas/Other malignant hematologic diseases	47	39.2%
Gynecological cancers	49	40.8%
Neurological pathologies	29	24.2%
Cardiac pathologies	33	27.5%
Other	26	21.6%

Regarding prescription frequency, 12.5% (N = 120) reported prescribing fewer than five PET scans per month, while 2.4% indicated prescribing between five and more than twenty per month, reflecting the still limited use of PET in clinical practice.

In terms of clinical indications, PET was mainly associated with oncological pathologies, particularly digestive cancers (54.2%), pulmonary cancers (49.2%), urological cancers (47.5%), gynecological cancers (40.8%), and lymphomas or other malignant hematologic diseases (39.2%). Cardiac (27.5%) and neurological (24.2%) indications were less frequently reported.

The main barriers to the use of PET (**Table 5**) were the absence of national availability of the examination (62.5%), followed by the lack of nearby PET centers (37.5%) and the high cost of the examinations (35.8%). In addition, 7.5% of respondents reported a lack of information regarding access to or procedures for PET use.

**Table 5.** Identification of barriers encountered by healthcare professionals regarding PET.

Responses	Frequency	Percentage
High cost	43	35.8%
No nearby PET center	45	37.5%
Not available nationwide	75	62.5%
I don't know/Uncertain	9	7.5%

### 3.4. Needs and Expectations

The needs and expectations of healthcare professionals regarding positron emission tomography (PET) in Senegal were explored across several dimensions, including the perceived future development of the technology, knowledge of radiotracers, strategic priorities, and required human resources.

Regarding the future development of PET in the country, 72.5% of respondents anticipated an increase in its use over the next five years, with 38.3% expecting a substantial rise. In contrast, 2.5% predicted no growth, and 25% did not express an opinion (**Table 6**).

Concerning radiotracers, 82.5% of professionals acknowledged that PET requires the use of specific radioactive molecules, whereas 12.5% indicated a lack of knowledge on this topic and 4.2% believed radiotracers were not essential. Furthermore, 77.5% were aware that their production requires specialized equipment (**Table 7**), although nearly half were unaware of the absence of a national production center in Senegal.

The most well-known radiotracers were [<sup>18</sup>F]-fluorodeoxyglucose (FDG), cited by 45.8% of respondents, followed by [<sup>18</sup>F]-fluoro-L-DOPA (17.5%), PSMA (16.7%), and DOTA-peptides (12.5%). Nevertheless, 45.8% reported being unfamiliar with radiotracers used in PET (**Table 8**).

A large majority of participants (85.8%) supported the establishment of a

**Table 6.** Estimated use of PET in the next five years.

Do you think PET use will increase in the next five years?	Frequency	Percentage
I don't know	30	25%
No	3	2.5%
Yes, substantially	46	38.3%
Yes, slightly	41	34.2%

**Table 7.** Use and production of radiotracers in PET, status of production in Senegal.

Statements	Frequency	Percentage
<b>A PET examination necessarily requires the use of radiotracers</b>		
I don't know	15	12.5%
No	5	4.2%
Yes	99	82.5%
Depends on the period	1	0.8%
<b>Production of radiotracers requires specialized equipment</b>		
I don't know	22	18.3%
No	5	4.2%
Yes	93	77.5%
<b>Are there radiotracer production centers in Senegal?</b>		
I don't know	50	41.7%
No	61	50.8%
Yes	9	7.5%

**Table 8.** Use of radiotracers in PET.

Which radiotracers do you use or would like to use?	Frequency	Percentage
FDG (Fluorodeoxyglucose)	55	45.8%
NaF (Sodium Fluoride - 18F)	14	11.7%
DOPA (6-[18F] fluoro-L-DOPA)	21	17.5%
PSMA (Prostate-Specific Membrane Antigen)	20	16.7%
DOTATATE (DOTA-peptides)	15	12.5%
FLT (Fluorothymidine)	3	2.5%
I don't know	55	45.8%

national radiotracer production facility to promote the development of PET in Senegal (**Table 9**). The priority locations proposed for its implementation were Dakar (89.2%), Ziguinchor (55%), Saint-Louis (53.3%), Diourbel (42.5%), and Thiès (35.8%).

**Table 9.** Healthcare professionals' opinions on the establishment of a national radiotracer production facility, priority areas, and required professional profiles

Question/Item	Frequency	Percentage
<b>Do you think a national radiotracer production facility would be useful?</b>		
Yes	103	85.8%
No opinion	17	14.2%
<b>Which regions of the country should be prioritized for such an initiative?</b>		
Dakar	107	89.2%
Diourbel	51	42.5%
Fatick	15	12.5%
Kaffrine	11	9.2%
Kaolack	34	28.3%
Kédougou	21	17.5%
Kolda	16	13.2%
Louga	9	7.5%
Matam	18	15%
Saint-Louis	64	53.3%
Sédhiou	11	9.2%
Tambacounda	31	25.8%
Thiès	43	35.8%
Ziguinchor	66	55%
I don't know	4	3.3%
<b>Which professional profiles are required for a radiotracer production facility?</b>		
Biomedical engineer	84	70%
Nuclear medicine physician	100	83.3%
Medical physicist	74	61.7%
Radiopharmacy technician	75	62.5%
Radiopharmacist	93	77.5%
Specialist physicians	48	40%
I don't know	2	1.7%

Finally, the professional profiles considered essential for the operation of such a facility included nuclear medicine physicians (83.3%), radiopharmacists (77.5%), biomedical engineers (70%), radiopharmacy technicians (62.5%), and medical physicists (61.7%).

## 4. Discussion

### 4.1. Respondent Distribution and Gender Aspects

This study involved 120 healthcare professionals practicing in Senegal, a country

where positron emission tomography (PET) is not yet available. The surveyed population was predominantly male (74%, **Table 1**), with a sex ratio of 2.9, reflecting the distribution observed in national medical practice. The underrepresentation of women may be attributed to several factors: limited exposure to PET, lack of familiarity with the discipline, perceived constraints related to radiation protection, particularly for women of childbearing age, as well as sociocultural and structural factors limiting female participation in technological or radiation associated specialties. A study on interventional radiology in Sub-Saharan Africa demonstrated that these barriers, including the lack of female role models and family related constraints, reduce women's participation in such fields [5]. To address this disparity, the future development of PET in Senegal should incorporate concrete measures aimed at promoting female participation. These could include targeted training programs in nuclear medicine, mentorship initiatives pairing junior female professionals with experienced practitioners, awareness campaigns highlighting career opportunities for women, and the implementation of gender sensitive radiation safety protocols. Such strategies would help ensure an inclusive, sustainable, and equitable growth of PET services in the country.

#### 4.2. Knowledge Level and Perception of PET

Despite the absence of dedicated positron emission tomography (PET) facilities in Senegal, a majority of participants (82.5%, **Table 7**) reported a satisfactory understanding of the basic principles underlying this imaging modality. However, objective assessment of PET knowledge revealed that only 39.2% of respondents achieved a perfect score, while 60.8% demonstrated insufficient knowledge or were unable to define PET (**Table 3**). This discrepancy suggests that, although healthcare professionals are generally familiar with the concept and potential applications of PET, likely due to postgraduate training, international collaborations, and advanced programs abroad [6], their detailed or technical knowledge remains limited. These findings underscore the need for structured, formal training programs to strengthen both theoretical understanding and practical competency in molecular imaging among healthcare professionals in Senegal.

[<sup>18</sup>F]-fluorodeoxyglucose (FDG) remained the most recognized and frequently cited radiotracer by participants (**Table 8**). This predominance confirms its central role in PET, particularly in oncological applications where it remains the reference radiotracer for tumor detection, staging, and therapeutic follow-up [7] [8]. Other radiotracers, such as [<sup>18</sup>F]-DOPA, PSMA, and DOTA-peptides, were also mentioned, reflecting an emerging interest in precision nuclear medicine and functional characterization of tumor tissues [9] [10].

However, nearly half of the participants reported being unfamiliar with the different radiotracers, highlighting gaps in both initial and continuing education. These findings emphasize the need to strengthen continuing education and academic programs in nuclear medicine, radiopharmacy, medical physics, and biomedical engineering. To address these gaps, several studies recommend reinforcing

ing local expertise to prepare for the effective introduction of PET into the African healthcare system [11]-[13].

### 4.3. Potential Uses and Areas of Interest

The current use of PET is non-existent in Senegal ; however, 11.7% of respondents reported having prescribed PET examinations. These prescriptions generally correspond to referrals to centers located outside the country, mainly in Morocco or France. Despite the absence of local PET facilities, the potential clinical applications of PET are clearly recognized by healthcare professionals. A large majority (72.5%, **Table 6**) anticipate a significant increase in PET utilization if the technology were to become available, particularly in the field of oncology (**Table 4**). The main barriers identified include the lack of infrastructure (62.5%, **Table 5**) and the relatively high cost of examinations (35.8%), reflecting both a strong latent demand and a high level of awareness of the clinical benefits of this diagnostic tool.

This perception aligns with observations from several international studies, which confirm that [<sup>18</sup>F]-fluorodeoxyglucose PET (FDG-PET) is the reference examination for assessing the initial extent of non-metastatic bronchopulmonary cancer [14]. Moreover, FDG-PET allows the detection of metastatic sites not identified by conventional imaging methods [15]. Its utility also extends to grading the malignancy of brain tumors and prognostic evaluation, thereby improving therapeutic planning and follow-up [16].

These results suggest a considerable potential for integrating PET into patient care in Senegal, particularly for digestive, pulmonary, urological, and gynecological cancers, where the added value of metabolic imaging is well documented.

### 4.4. Expressed Needs and Development Perspectives

Surveyed healthcare professionals expressed a clear and structured need for the development of PET and local production of radiotracers. The establishment of a national radiotracer production facility was deemed relevant by 85.8% of respondents (**Table 9**). Such an infrastructure would enable the provision of radiotracers close to nuclear medicine services, considering their short half-life, while ensuring a reliable and continuous supply, thereby reducing dependency on imports [17].

The prioritized implantation areas, Dakar, Ziguinchor, Saint-Louis, Thiès, and Diourbel, reflect a desire for a more equitable territorial distribution of molecular imaging. This choice mirrors the reality of a strong centralization of human resources and medical infrastructure in major cities, particularly Dakar, where approximately 70% of physicians and 80% of pharmacists and dentists are concentrated, although this region accounts for only about 42% of the national population [18] [19]. This unequal distribution limits access to specialized examinations and generates diagnostic delays, as reported in several studies conducted in sub-Saharan Africa [20]-[22].

These observations highlight the need for a structured national plan for the de-

velopment of nuclear medicine in Senegal, including:

- training of qualified human resources, particularly in nuclear medicine, radiopharmacy, medical physics, and biomedical engineering, to sustainably strengthen local expertise [20].
- establishment of regional radiopharmacy units to ensure radiotracer availability, reduce logistical delays, and enhance system resilience.
- promotion of sustainable scientific and technological autonomy by supporting applied research, knowledge transfer, and locally adapted production to meet clinical needs [17] [22].

Thus, the development of a national radiotracer production facility addresses not only a logistical challenge but also represents a strategic lever for territorial equity, improved diagnostic performance, and consolidation of local scientific competencies.

#### 4.5. Study Limitations and Perspectives

This study has several limitations. First, the sample is predominantly concentrated in Dakar (**Table 1**), which limits national representativeness and the generalizability of the results to the entire country. Previous studies on the distribution of healthcare professionals in Senegal have shown that the capital disproportionately concentrates medical and paramedical staff, reflecting the same trends observed in our survey [18] [19]. Additionally, participants were recruited using a convenience sampling strategy with elements of snowball sampling, which may have introduced a selection bias and affected the diversity of respondents. This should be considered when interpreting the results, as it may limit the generalizability of findings to the wider population of healthcare professionals.

Second, the data collected were based on participants' self-reported responses, which may be influenced by individual perceptions or subjective understanding of the questions, introducing potential perception bias. Such bias can arise from subjective interpretation of questions, partial recall, or social desirability [23]. Additionally, the quality of responses may vary depending on the mode of questionnaire administration, affecting comprehension, accuracy, and honesty of the answers provided [24]. Finally, using the same source to assess multiple variables can introduce common method bias, potentially inflating correlations and compromising causal interpretation [25].

Moreover, the current absence of PET in Senegal does not allow for the assessment of actual clinical use, but only of intentions, perceptions, and expectations of healthcare professionals.

Despite these limitations, the results highlight a clear interest in PET and well-identified needs. The development of a national radiotracer production facility, targeted training of qualified professionals, and establishment of regional PET centers represent strategic priorities for the effective and sustainable introduction of this technology, particularly in oncology [11]-[13].

Furthermore, female participation should be encouraged through specific

training in radiobiology and radiation protection to ensure inclusive and sustainable integration into this high-potential sector, thereby promoting health equity and the development of local expertise [20] [21].

## 5. Conclusion

This study provides the first nationwide assessment of healthcare professionals' perceptions, knowledge and expectations regarding positron emission tomography (PET) in Senegal. Beyond documenting current knowledge levels, it highlights a substantial latent demand for PET imaging, particularly in oncology, despite the absence of local facilities. These findings underscore the existence of a clear clinical need rather than a lack of awareness or interest among professionals. From a policy perspective, the results emphasize the strategic importance of investing in PET infrastructure, including the establishment of a national radio-tracer production facility and the development of specialized training programs. Addressing structural barriers and promoting gender equity in nuclear medicine are essential steps to ensure sustainable and inclusive implementation. As a foundational study, this work provides valuable evidence to inform health policy decisions and investment planning in Senegal. More broadly, it serves as a reference framework for the development of nuclear medicine in West Africa, supporting improved diagnostic capacity, optimized therapeutic monitoring, and strengthened regional biomedical research.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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