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One Health Approach Necessity in the Control of Highly Pathogenic Avian Influenza: *An Integrated Analysis of Decision Makers' Perspectives in Ivory Coast, Using Peter Checkland's Soft System Methodology*

To be efficient, the control of highly pathogenic avian influenza requires an integrated, synchronized, participatory and inclusive strategy. In Ivory Coast, whatever the decision makers' profile (veterinarian, physician, environmentalist, farmer…), the levers of integrated zoonoses control were: Joint preparation, decompartmentalization, anticipation and the mutual resources sharing in proportion to the benefits.

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Abstract

The control of highly pathogenic avian influenza (HPAI) requires an integrated strategy. In Ivory Coast, it is decentralized and included in the health policy (as all tools, including SOPs, for managing disease prevention and control) but would lack a common vision and stable bridges for intersectoral exchanges and major health challenges joint planning. Thus the need to identify levers for action through the key sectoral decision makers' perspectives in integrated HPAI control. A cross-sectional retrospective qualitative study, respecting ethical considerations, was carried out in May 2023 with national decision makers from the human, animal, environmental and community health sectors in Ivory Coast. Purposive sampling was guided by seven respondents based on the saturation principle. An open-ended, semi-structured interview grid based on the CATWOE components (*C*: Clients, *A*: Actors, *T*: Transformation process, *W*: Weltranschauung, *O*: Owners, *E*: Environment; Smyth D. and Checkland P. en 1975) were used to analyse the surveyed decision makers' perspectives, using QDA^{Miner4Lite} software. Findings showed four emerging perspectives, depending on the decision makers' profile: (i) Veterinarians advocated a world better prepared to deal with HPAI, with simulation exercises (as one of the four components of the International Health Regulations monitoring framework to enable the lessons learned from a simulated public health event that can be capitalized on while strengthening the response system), joint investigations and training, creation of reactive and autonomous regional centres with enhanced technical facilities; (ii) Poultry industry (private sector) is also moving in the same direction, with the idea of common funds pre-mobilized through poultry farmer contributions to facilitate future compensation; (iii) Physicians prioritized the cross-sector sharing of digitized information in real time, the mutualization of resources and the integration of existing surveillance networks; and (iv) Environmentalists were keen to integrate aspects of other key sectors into their sectoral monitoring tools in order to be more alert and proactive in an ecological dynamic.

What is the Incremental Value that Makes this a One Health Case?

This project's aim was to understand the vision of physicians, veterinarians, environmentalists and farmers' representatives decision makers in the Ivory Coast, on the changes needed in the fight against highly pathogenic avian influenza (HPAI). In fact, this zoonosis calls on the expertise of actors from the various sectors mentioned above for efficient management through the mutualization of resources, a source of financial and human capital savings for these sectors. This added value of the multi-sectoral approach, imposed by the nature of the disease, can also be seen in the prevention pro-activity, which no longer waits for the diagnosis of HPAI in humans before taking action, but begins with the application and monitoring of biosecurity measures in domestic poultry on the one hand, and the surveillance of avifauna, especially migratory birds, on the other. This intersectoral collaboration, combined with community participation by farmers, has strengthened the effective ownership of the control measures by the actors involved.

Learning Outcomes

1. Recognise that integrating health (animal and human) aspects into environmentalists' surveillance tools means that key sectors can be better alerted, thereby improving the proactivity of interventions, the early stage of detection and the responsiveness of the system for resilient, sustainable surveillance of HPAI in poultry.
2. Understand that strengthening regional technical capacity for preparedness through joint missions (in conjunction with all the sectors involved) to monitor and evaluate mechanisms for responding in non-emergency situations (simulation exercises) improves the system for managing HPAI epizootics/epidemics at the appropriate time.

Background and Context

Avian influenza (AI), commonly known as "bird flu", is a highly contagious respiratory infectious disease caused by the avian influenza virus (AIV), which affects poultry (both domestic and wild) and humans and is therefore potentially zoonotic (Bilan de la situation épidémiologique de l'influenza aviaire au niveau mondial, 2018; Influenza (Seasonal), 2023). It is often seasonal, with four types (A, B, C and D), including A and B, which are responsible for seasonal epidemics with their own subtype behaviour, making them difficult to manage ((PDF) Situation épidémiologique globale de l'influenza aviaire hautement pathogène (2015–2016), 2016; Global AIV with Zoonotic Potential, 2023). AI is also classified according to severity as low pathogenic avian influenza (LPAI) a/pauci symptomatic and highly pathogenic avian influenza (HPAI) with obvious clinical signs, high mortality and considerable socio-economic impact, making it a real public health issue (Influenza (Seasonal), 2023; Situation de l'IAHP en Afrique sub-saharienne, 2023). HPAI has several subtypes, of which Influenza A (H5N1) is the most ubiquitous, with a total of 862 human cases worldwide since 2003. Also known as "classical avian influenza", it is endemic in several Asian and African countries. In fact, since its reintroduction in West Africa in 2014, H5N1 has presented several reassortant clades, with occasional human cases in Laos (2020) and Nigeria (2021). In 2022, H5N1 was found in the USA (Colorado), Spain, Vietnam and Ivory Coast, where it was responsible for the culling of around 150 livestock farmers, who were compensated for the socio-economic impact of the response. Following the example of the rest of the world, H5N1 persists in Ivory Coast with stereotyped seasonality, despite the strategies put in place such as integrated surveillance of HPAI, the coordination and operation of which remain problematic and a priority for the Ivorian authorities in the era of globalization. (Situation épidémiologique globale de l'influenza aviaire hautement pathogène (2015–2016), 2016; Global AIV with Zoonotic Potential, 2023; Influenza (Avian and Other Zoonotic), 2023; Mondialisation et recompositions territoriales identitaires en Océanie insulaire- fdi:010031616- Horizon, 2003; Situation de l'IAHP en Afrique sub-saharienne, 2023).

Analysis of the conceptual framework for this project (Fig. 1) actually shows that globalization plays a role in the persistence of HPAI, since it involves all the exchanges of resources (human, material, including goods, financial and information) that link the different parts of the world, thereby encouraging high levels of urbanization (Exploitation forestière illégale, 2022; Urbanisation, 2022). This is defined as a continuous phenomenon of growth and concentration of the urban population accompanied by the extension of towns under construction and industrialization, hence its association with the rural exodus and over-exploitation

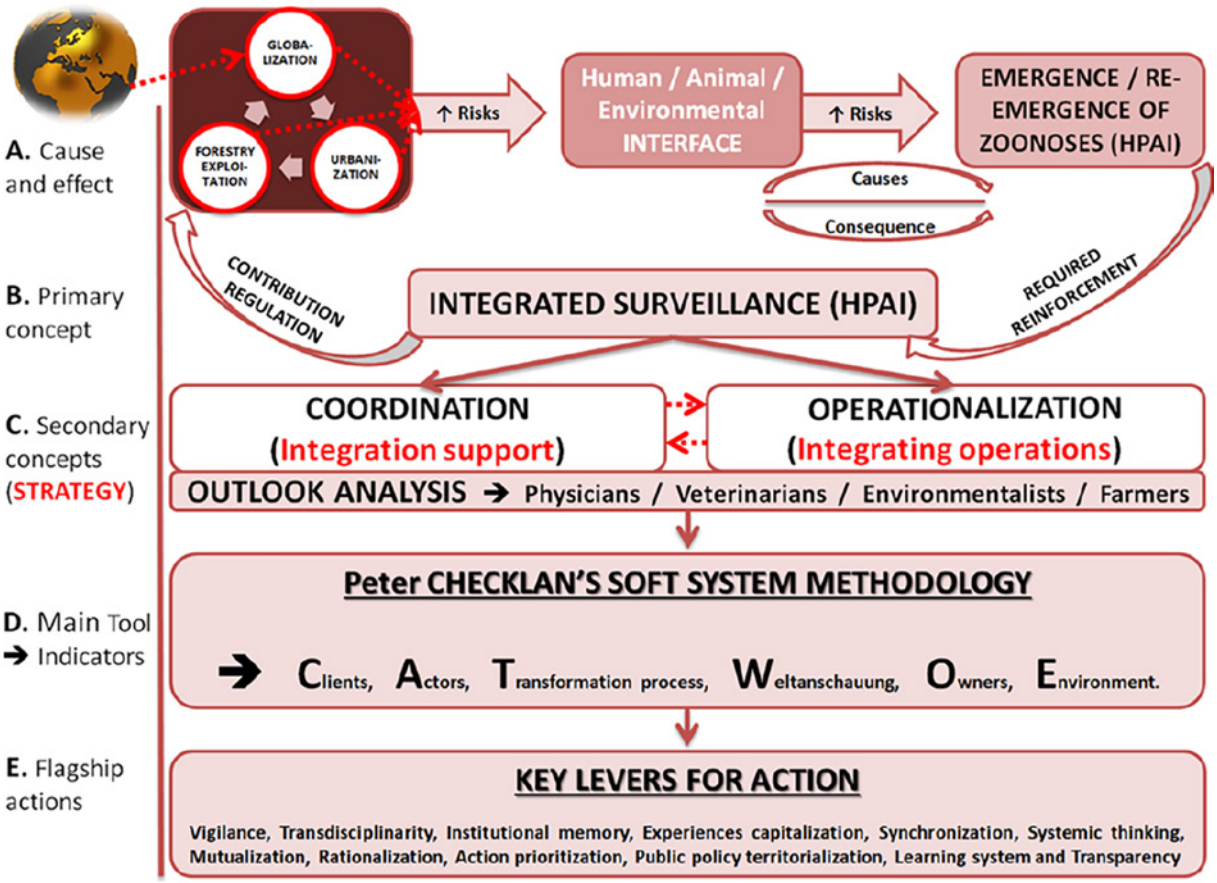

Fig. 1. Conceptual framework for analysing decision makers' perspectives on HPAI control, Ivory Coast, 2023.

of forests (L'exploitation forestière : Récolter du bois, 2020; Urbanisation, 2022). Forest exploitation, or the production process involving forest resources with a view to transporting them to a processing site (often the big cities), would increase the Human-Animal-Environment interface, with consequences not only for biodiversity (bird species threatened with extinction) but also for health, with the emergence and/or re-emergence of zoonotic diseases such as HPAI (Beapi, 2019; FAO, 2019; Zoonoses|INSPQ, 2023; La moitié des espèces d'oiseaux en déclin dans le monde, selon l'ONG BirdLife, 2022). This requires epidemiological surveillance that integrates the knowledge of all the key sectors involved in the form of a systemic, transdisciplinary and unified approach to better address potential public health risks. It is with this in mind that the regional World Health Organisation (WHO) has adopted the strategy of integrated disease surveillance (including HPAI) and response (IDSR) in Africa, enabling early detection of epidemics, but also system reactivity (response) to them, provided that it is operational and well-coordinated as can be seen in Fig. 1, which illustrates the conceptual framework of this study, analysed from top to bottom, from the general to the specific, respectively (Blais *et al*., 2014; Comité régional de l'Afrique, 2019; Zinsstag *et al*., 2020; Antoine, 2003; www.unitheque.com, 2011). Hence the importance of using a one-health approach to analyse (qualitatively and retrospectively) the perspectives of decision-makers in the prevention and control of HPAI in Côte d'Ivoire in May 2023.

Transdisciplinary Process

This perspective analysis involved both the public and private sectors, with national decision makers from the following sectors: (i) human health (two doctors, one from the Ministry of Health and Public Hygiene and another from the One Health Platform); (ii) animal health (two veterinarians, one from the Ministry of Animal Resources and Fisheries (*MIRAH*) and another from the Armed Forces Health Service); (iii) environmental health (two environmentalists, including one from the Ivorian Office of Parks and Reserves (*OIPR*) and one from the Ministry of the Environment and Sustainable Development); and (iv) community health with the national representative of farmers on the Ivorian Poultry Interprofession (*IPRAVI*)). Thus a purposive sampling was guided by these seven respondents described above on the basis of the saturation principle.

A semi-structured open-ended interview grid based on the components CATWOE (*C*: Clients, *A*: Actors, *T*: Transformation process, *W*: Weltranschauung, *O*: Owners, *E*: Environment; Smyth D. and Checkland P. in 1975) was used for information collection during free and participative discussions, which in turn enabled a thematic analysis to be carried out on the QDA[Miner4Lite] (version 1.4.1) software.

Project Impact

This project has had a direct impact on the management of the fight against HPAI, especially as it has provided an opportunity for an exchange of views based on deep-seated convictions (Roots definitions) between decision makers from the various key sectors who have been directly or indirectly involved in managing the response to past HPAI epizootics (since 2006) in Ivory Coast. Overall, four major transformation processes emerged, grouped by sector or profile (Fig. 2).

Fig. 2. Summary of the views of the CATWOE analysis on the perspectives of decision makers, Ivory Coast, 2023.

Human health with physicians

Their decision makers transformation processes are moving in the direction of information sharing, with a worldview centred on real-time surveillance, joint investigations, mutualization of resources and capitalization on pre-existing sentinel surveillance networks. This was also raised on the one hand by a man, academic, from the human health: "*…we've had a sentinel surveillance network for avian flu since 2006*, *because we want to be informed in real time so that we can put measures in place*, *such as monitoring farmers and people exposed to this poultry over a 14-day period […] I think we need to move towards electronic surveillance*, *from alert to information for decision-making purposes…*"; and on the other hand by a woman, academic, from the global health: "*…the simulation exercise organised earlier helped a lot when the epizootic broke out…*". Indeed, simulation exercises have been recommended by the WHO (International Health Regulations (IHR) Monitoring Framework) because of their learning effect on actors and, above all, because they strengthen their ability to respond appropriately and at the right time (afr_rc60_9_fr.pdf, 2010). This was corroborated in 2014 by *KECK F*. in his work on: *The triage foreground*. *Simulation of a pandemic in Hong Kong* in China (Keck, 2014). Table 1 illustrates the CATWOE analysis of the prospects for decision makers in the fight against HPAI in Ivory Coast.

Table 1. CATWOE analysis of physician decision makers' perspectives on HPAI control, Ivory Coast, 2023.

Item	Contents
Targets: Physicians involved in the fight against HPAI	
C (*Customers*/Clients)	Institutions in the animal health, human health, environmental health, defence (army health), sentinel surveillance network (laboratories) and community sectors.
A (*Actors*/Resources)	Real-time surveillance, Joint investigation, Mutualizing of resources, Simulation exercises, Capitalisation of surveillance network, Sharing of reports
T (*Transformation process*/Transformation)	Moving from a disconnected physical surveillance system to an interconnected and interoperable electronic surveillance system with mutualized and efficient resources
W (*Weltanschauung*/World view)	Optimum digital monitoring, where all the essential points are properly addressed using a single information exchange platform based on a one-health approach.
O (*Owner*/Proprerty)	Decision makers (Political and Strategic)
E (*Environmental constraints*/Assets)	Institutional framework, political involvement, different agendas (technical and political), lack of government resources (domestic funding)

Root definition: In a world of digitalized optimal surveillance based on a one-health approach, with a single information exchange platform and an institutional framework adapted to the beneficiary stakeholders.

Animal health with veterinarians

The transformation processes of decision makers in the animal health sector are moving in the direction of preparation, as shown by their Root definition objectified in Table 2 demonstrating the importance of transdisciplinary preparation, including the words of a man, academic, from animal health sector: "*… it was one of the ladies (farmers) who took part in the 2020 simulation exercise who warned about the 2021 case*. *This already shows the importance of simulation exercises*, *but also the importance of involving key actors […] The creation of health emergency operations center (HEOC) in veterinary public health is necessary for the fight against zoonoses*…". In addition, the focus has been on capacity building using existing joint training opportunities at the local level, which could improve the responsiveness of the system as supported by a man, academic, from the armed forces animal health sector: "*…training courses such as the Field epidemioloy training program (FETP) and the In Service Applied Veterinary Epidemiology Training (ISAVET)*, *they are truly One Health*, *it's the basis of the integration process because if you are trained together and you meet up in the field it makes it easier to understand and to manoeuvre together if necessary…"*. This idea of preparedness contributing to a better response to social stability was corroborated by the study carried out by the team of Lubroth *et al*. (2017).

Table 2. CATWOE analysis of veterinaran decision makers' perspectives on HPAI control, Ivory Coast, 2023.

Item	Contents
Targets: Veterinarians involved in the fight against HPAI	
C (*Customers*/Clients)	Authorities (central, decentralized), Local leaders, Private sector, Livestock farmers, Defence and security forces (Army, Police, *Gendarmerie*), Press, Technical and financial partners, Communities, Human and environmental health…
A (*Actors*/Resources)	Simulation exercises, investigation, culling, HEOC and regional laboratories (Abidjan, Bouake, Korhogo), emergency funds, joint training (FETP, ISAVET, etc.)
T (*Transformation process*/Transformation)	Moving from a system that is more or less prepared to one that is better prepared to deal with HPAI
W (*Weltanschauung*/World view)	All staff are ready and therefore well prepared to combat HPAI in an integrated manner, with shared knowledge and mutualized resources.
O (*Owner*/Proprerty)	Administrative authorities, Politics
E (*Environmental constraints*/Assets)	Ownership of the strategy by the actors, Financial aspects

Root definition: In a world where agents are prepared, resources are mutualized, and the fight is integrated and appropriated by actors for their own benefit.

Environmental health with environmentalists

The transformation processes of decision makers in the environment sector are moving in the direction of integrating (animal and human) health aspects into their activities on wildlife, with a root definition that aims towards pro-activity in control, as illustrated in Table 3 and the assertions of a man, academic, from the Environmental sector: "*…It occurs periodically*, *and the whole sub-region is affected*. *Avifauna plays an important role in the transmission of the disease*. *That's why we need to keep an eye on these wild birds*. *That's why we're trying as far as possible to include key elements in the monitoring of avifauna*, *such as the January and June inventories…*". Furthermore, the lack of involvement of the environment sector is deplored by a woman, academic, from the Environmental sector: "*… Even though we are involved and receive all the information*, *we can say that wildlife has been somewhat neglected up to now in terms of prevention*. *We don't have a veterinarian or a physician at the Ministry of Water and Forests*, *so we can't carry out in-depth studies in this area*, *even though we'd like to know whether wildlife cohabitation constitutes a risk…*.". This position regarding avifauna is, in fact, very plausible and is corroborated by the studies of Picoux *et al*. in France where it was found that avifauna can act as a reservoir for HPAI epizootics (Brugere-Picoux, 2005).

Table 3. CATWOE analysis of environmentalist decision makers' perspectives on HPAI control, Ivory Coast, 2023.

Item	Contents
Targets: Environmentalists involved in the fight against HPAI	
C (*Customers*/Clients)	MIRAH, Laboratories, OH Platform, Ministry of Health, Ministry of Water and Forests, Community (village conservation and development associations) and NGOs.
A (*Actors*/Resources)	SMART tool, Integration workshops with other sectors (animal and human), Inventory of wild (water) birds
T (*Transformation process*/Transformation)	Moving from lethargy to the effectiveness of an integrated, proactive wildlife monitoring system to provide better alerts to key sectors, including the One Health Platform.
W (*Weltanschauung*/World view)	All the development plans for the 17 protected areas include health aspects (animal and human)
O (*Owner*/Proprerty)	Decision makers, Politics
E (*Environmental constraints*/Assets)	Possibility of changing monitoring objectives, Availability of resources, Technical and financial partners

Root definition: In a world of efficient collaboration on health aspects integrated into protected areas development tools and plans for the benefit of stakeholders.

Community health with farmer representative

A private sector decision maker (a man, non-academic and at the national level) presents a different transformation process in the direction of support for compensation which would be much closer to vets' idea of preparation, as shown not only by his point of view in Table 4 but above all his following assertions: "*… the weak point is that the compensation rates have not been reviewed to take account of the current rate of inputs and*, *above all*, *to take account of mortality before culling […] We need to use the existing frameworks for mobilization and collection (poultry farmer contributions)*, *which are governed by the law in force (interministerial decree) on the fight against bird flu*, *to facilitate future compensation […] And we have met with the Director of Veterinary Services to see how we can help*, *as far as we are concerned*, *with awareness-raising*, *which is an approach to preventing avian flu…*.". In fact, this idea of the crucial role of communication was also corroborated in the 2004 studies on the subject by Michel *et al*. in France (Michel *et al*., 2004).

Project Outlook

First, this project could open up to other studies in the context of synchronous monitoring, on the one hand of early detection in avifauna; and on the other hand of screening for asymptomatic cases in people at risk, especially those in the poultry industry. The added value of molecular epidemiology could help identify the phylogenetic origin of any strains found in poultry or humans and correlate them with those found in domestic poultry.

Table 4. CATWOE analysis of the perspectives of the decision maker farmers' representative (community) on HPAI control, Ivory Coast, 2023.

Item	Contents
Targets: Farmers involved in the fight against HPAI	
C (*Customers*/Clients)	Interprofession (Farmers/IPRAVI), MIRAH, Technical and financial partners, Operators, Members with exceptional contributions
A (*Actors*/Resources)	Mobilization framework, deduction framework (Contribution), Use of interministerial decree (formalize, sign a prior agreement within the professional family), raise awareness
T (*Transformation process*/Transformation)	Move from the current compensation rate (2023) to a better rate based on communication, organization and structuring at national level
W (*Weltanschauung*/World view)	Establish effective mechanisms to promote the poultry industry by setting up an autonomous common fund to support compensation.
O (*Owner*/Proprerty)	Law (common to all interprofessions)
E (*Environmental constraints*/Assets)	Resources, Subscription supported by the regulatory and legal framework in force in Ivory Coast

Root definition: In a world with effective poultry promotion mechanisms and autonomous pooled funds based on communication, organization and pre-existing law.

Then from a managerial point of view, the need to organize an after-action review (AAR) of all HPAI epizootics since the 1st case in Ivory Coast (2006) would enable all actors, including non-academics, to sit around a table and rethink the national strategy for HPAI control. It would also help to strengthen the effectiveness in Ivory Coast of the above-mentioned IHR monitoring framework, which aims to build the capacity of States Parties to prevent, detect and respond to public health events or emergencies such as HPAI.

Last but not least, monitoring the prospects for integrating epidemiological surveillance tools using a One Health approach, including a platform for exchanging information in real time, would make the surveillance system more interconnected and interoperable on the one hand, and would strengthen the effectiveness of the willingness of all decision makers, regardless of the sector to which they belong, on the other.

Conclusions

Basically, this project has shown that, in reality, decision makers have similar or complementary perspectives, whatever their sector of origin or profile (physician, veterinarian, environmentalist, farmer, etc.). So the common vision is finally very much in evidence in Ivory Coast, but the fact that the system's strengths and opportunities are not being exploited to the full is hampering the co-construction of stable bridges for cross-sectoral exchanges for joint planning and implementation of major health challenges and interventions respectively. A greater strategic repositioning of the One Health platform would enable optimal and more harmonious integration of knowledge (both academic and non-academic) by putting all stakeholders at the same decision making level, whatever their sector or culture of origin. This would boost self-confidence and remove certain inhibitions.

- Decision makers have similar or complementary perspectives, whatever their sector of origin or profile.
- One-health platform strategic repositioning would enable optimal and harmonious knowledge integration (whether academic or not).
- Putting all actors at same decision making level, increases transdisciplinarity, boosts self-confidence and removes inhibitions.

Group Discussion Questions

It is always important to keep a critical eye on the ways in which we manage complex problems and, above all, to keep thinking about the ways and means of resolving them, all the more so in an unstable, changing and uncertain environment. With this in mind, we need to take an introspective look at:

1. How should the priorities and motivations of stakeholders from different (sectoral and/or cultural) backgrounds be managed in a process of inter/multisectoral, or even transdisciplinary, collaboration in an emergency situation in order to achieve optimum benefit?

2. How much importance do academic actors attach to the participation and, above all, to the contributions of non-academics in the quest for a consensus on strategies to combat zoonotic diseases such as HPAI?
3. What should be the degree of involvement (financial, material, logistical, human and infrastructure) of the environment and human health sectors in the event of an HPAI epizootic, even if the animal health sector naturally has the lead?

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Conflict of interest

The authors declare no conflict of interest.

Ethical Statement

Reflexivity was managed by an interviewers' logbook with strict respect for anonymity and confidentiality. The free and informed consent of the interviewees was obtained beforehand on the basis of a clear explanation of the project's objectives and the right to refuse and stop the data collection process at any time and without any explanation. The project benefited from research authorizations from *MIRAH* and its collaborators prior to the start of the fieldwork.

Further Reading

Contingency plan to control HPAI in Ivory Coast; MIRAH's strategic respond plan for the HPAI control in Ivory Coast; IHR monitoring framwork. (Yx *et al*., 2019; ca0990fr.pdf, 2023; i9055fr.pdf, 2023).

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