



Determinants of Perinatal Deaths among Births with Complications in Kasai Province from 2022 to 2024

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Abstract

Introduction: Neonatal mortality remains a major public health problem worldwide. A World Health Organization report indicates that 4 million children die before their first month of life. In Africa, an analysis has shown that perinatal mortality rates range from 66 to 124 per 1000 live births. In the Democratic Republic of Congo (DRC), the perinatal mortality rate remains high, estimated at 32 per 1000 live births. The objective of this study Identify the factors associated with perinatal deaths among births with complications in Kasai Province. **Methods:** This was a mixed-methods study, combining quantitative and analytical approaches. A case-control analytical design was complemented by a phenomenological design. The study was conducted in Kasai Province from 2022 to 2024 and included 798 records of newborns who experienced birth complications. **Results:** Among newborns who experienced birth complications, 33.3% died, reflecting a high obstetric mortality rate, even though DPS reports indicate a perinatal mortality rate of 2 deaths per 1000 live births. Factors associated with these deaths were living in a rural area, prematurity, lack of antenatal care visits, low birth weight, and male sex ($p < 0.05$). Neonatal sepsis, asphyxia, and dystocia were also contributing factors ($p < 0.05$). Responsibility for perinatal deaths was shared among the community, healthcare facility administration, and healthcare providers. **Conclusion:** Perinatal mortality remains high in the DRC, particularly in Kasai Province. The

observed perinatal deaths are linked to largely preventable factors and involve multiple responsibilities. An integrated approach, taking into account community, institutional, and professional dimensions, is essential for a lasting reduction in perinatal mortality.

Subject Areas

Global Health

Keywords

Perinatal Deaths, Associated Factors, Kasai Province, DRC

1. Introduction

Worldwide, approximately 4 million children die each year before reaching their first month of life [1]. While access to quality perinatal care significantly increases newborn survival [2], the situation varies considerably from country to country. In Europe, neonatal mortality ranged from 17 to 33 per 1000 live births in Germany [3], while it was 13.7 per 1000 in France [4]. These disparities are explained by the fact that neonatal mortality is closely linked to geographic region, but also to gestational age [5]-[7]. Furthermore, other clinical and biological factors are associated with it, such as the child being male, vaginal delivery, and sepsis [8].

In Africa, neonatal mortality remains high, as indicated by several studies. An analysis of ten hospital studies showed that perinatal mortality rates ranged from 66 to 124 per 1000 live births [9]. This rate was 60.5% in a study conducted in Lomé [10]. Prematurity was one of the identified causes [11]. Other studies reported rates of 25.4% in Algeria and 26.5% in Côte d'Ivoire [12] [13]. Prematurity and neonatal infection were implicated in these deaths. In Tunisia and Cameroon, the neonatal mortality rates were 22.5 per 1000 live births and 20.2%, respectively [14] [15]. The causes and contributing factors were asphyxia, neonatal infections, prematurity, congenital anomalies, and inadequate prenatal care. Another study showed that late initiation of early breastfeeding, an Apgar score below 5 at 5 minutes, low birth weight, hypothermia, and premature rupture of membranes increase the risk of neonatal mortality, which is, conversely, reduced by cesarean delivery and the use of antenatal care [16].

A review of studies conducted in Yaoundé and Dakar showed that asphyxia, prematurity, and infection were major causes of neonatal death [17]. In Lagos and Ethiopia, the factors contributing to these deaths were associated with the mother living in a rural area, lack of antenatal care, low birth weight, prematurity, dystocia, abnormal presentation, antepartum hemorrhage, and hypertensive disorders [18]-[20]. However, attending at least four antenatal care visits, having good knowledge of the main danger signs, and the presence of a skilled birth attendant have been reported to be associated with a reduction in perinatal mortality [21].

Respiratory distress syndrome, advanced maternal age, and fetal growth restriction have also been implicated in neonatal deaths [22] [23].

In the DRC, a perinatal mortality rate of 32 per 1000 live births was recorded at Dr. Rau/Ciriri Hospital in South Kivu. The main associated factors were pregnancy-related illnesses, fetal growth restriction, inadequate prenatal care, prematurity, and advanced maternal age [24].

A study conducted in Goma noted that neonatal mortality was influenced by maternal factors such as maternal age, insufficient prenatal care, urogenital infections, and poverty; but also by neonatal factors such as low birth weight, and the sex and age of the newborn [25].

In Kasai Province, for a neonatal mortality rate of 47 per 1000 live births recorded in three maternity wards of hospitals in the Luebo Health Zone in Kasai, DRC, the main associated factors were low birth weight, gestational age less than 36 weeks, anemia during pregnancy, cesarean delivery, malaria during pregnancy, and fewer than 3 prenatal visits [26].

The objective of this study was to identify the factors associated with perinatal deaths among births that presented complications in the Kasai Province.

2. Methods

2.1. Study Design

This was a mixed-methods study with a comprehensive design. The quantitative component comprised two parts. The first part was cross-sectional and analytical. The second part consisted of a case-control study that established links between perinatal deaths and underlying factors. The study covered a three-year period, from January 1, 2022, to December 31, 2024.

2.2. Study Framework

This study was conducted in the 18 health zones of Kasai Province, in the Democratic Republic of Congo (DRC).

2.3. Study Population

The study population consisted of newborns who died and those who experienced complications during the first 28 days of extrauterine life during the study period.

2.4. Sampling and Eligibility Criteria

Regarding the sampling method, for the quantitative component, the study adopted an exhaustive approach by including all perinatal deaths recorded in the documentary sources of the 18 health zones of the Kasai Provincial Health Directorate (DPS). We matched one case to three controls (1:3). This was a one-to-one match, where the cases were perinatal deaths occurring in the departments and the controls were complications recorded in the same departments and during the same period. We have collected 1059 files.

For the qualitative component, a purposive selection process was applied to

choose participants. They included secondary actors (healthcare providers) and primary actors (community members, community health workers, and community leaders) divided into 10 focus groups of 8 to 10 people.

Regarding the inclusion criteria, for the quantitative component, all complete and usable medical records of newborns who experienced complications or died during their first 28 days of life in the targeted health zones were retained. The qualitative component included healthcare providers and community members who voluntarily agreed to participate in the study.

Regarding exclusion criteria, for the quantitative component, incomplete medical records or those lacking the variables necessary for analysis were excluded. For the qualitative component, any person who did not formally give their informed consent or who decided to withdraw from the process was excluded from the study.

2.5. Study Variables

The dependent variable was perinatal death. The independent variables concerned maternal characteristics (age, place of residence, marital status, level of education, occupation, parity, inter-pregnancy interval, ANC follow-up) and newborn characteristics (gestational age, age, sex, birth weight [according to gestational age], presence of asphyxia, neonatal sepsis/infection, congenital malformation, twin pregnancy).

2.6. Data Collection and Statistical Analysis

For the quantitative component, data collection was carried out through a review of hospital records. The tools used were maternity registers, prenatal care (ANC) consultation forms, delivery registers, partograms, hospitalization registers, and perinatal death review forms. A standardized survey questionnaire was pre-tested on 20 records to adjust the tool in terms of clarity and usability. Each record was assigned a unique code. The data were entered into a secure Excel database and then saved to an external storage device. For the qualitative component, data were collected using a semi-structured interview guide administered until saturation, through interviews and focus groups with healthcare providers, health zone managers, and community leaders/liaisons.

Quality assurance ensured data reliability. Interviewers and supervisors were rigorously recruited based on their education level and experience, and received prior training. Systematic triangulation was performed between data from health facilities, data transmission tools, DHIS2 data, and verbatim transcripts from the various focus groups (community and management teams).

2.7. Ethical Considerations

The research protocol was formally approved by the Ethics Committee of the Faculty of Medicine at the University of Lubumbashi (No. UNILU/CEM/036/2025). Authorization from the provincial health authorities, informed consent, confiden-

tiality, and fairness were required before data collection began.

3. Results

3.1. Sociodemographic Characteristics

Table 1. General characteristics of newborns and mothers included in the study (Kasai Province, 2022-2024).

Variables		Effectifs (N)	Pourcentage (%)
Gestational Age	<30 weeks	31	2.93
	31 à 36 weeks	266	25.12
	>36 weeks	762	71.95
Mother' age	<18 years	26	2.46
	18 à 40years	1011	95.47
	>40 years	22	2.08
	Means $\pm$ SD	28.6 ($\pm$ 6.83)	
Place or origine	Rural	755	71.29
	Urban	304	28.71
Study level	Primary	470	44.38
	Secondary	550	51.94
	University	39	3.68
Number of children (parity)	Primiparous	398	37.58
	Pauciparous	269	25.40
	Multiparous	392	37.02
Statut matrimonial	Single	139	13.13
	Maried	920	86.87
Birth weight	<2500 g	201	18.98
	2500 to 3500 g	787	74.32
	>3500 g	71	6.70
	Means $\pm$ SD	2943.17 ($\pm$ 600.17)	
Sex	Female	640	60.43
	Male	419	39.57

The study included a total sample of 1059 newborns in Kasai Province between 2022 and 2024. Regarding maternal age, 2.46% of the newborns were born to mothers under 18 years old. Males represented 39.57% of the sample. A large majority (74.32%) had a normal birth weight, ranging from 2500 to 3500 grams (See **Table 1**).

The profile of the mothers in the study was characterized by a majority residing in rural areas (71.29%) and an age group largely concentrated between 18 and 40 years (95.47%). More than two-thirds (71.95%) of the babies were born after a pregnancy of more than 36 weeks of amenorrhea.

Perinatal Mortality Rate in Kasai Province (2022-2024)

Between 2022 and 2024, the DHIS2 system recorded 730,934 live births and 1303 perinatal deaths, representing a perinatal mortality rate of 2%. Targeted analysis of our surveys reveals a much more critical situation, with 353 perinatal deaths out of 1059 recorded obstetric complications, representing a case fatality rate of 33.3%. (See **Figure 1**)

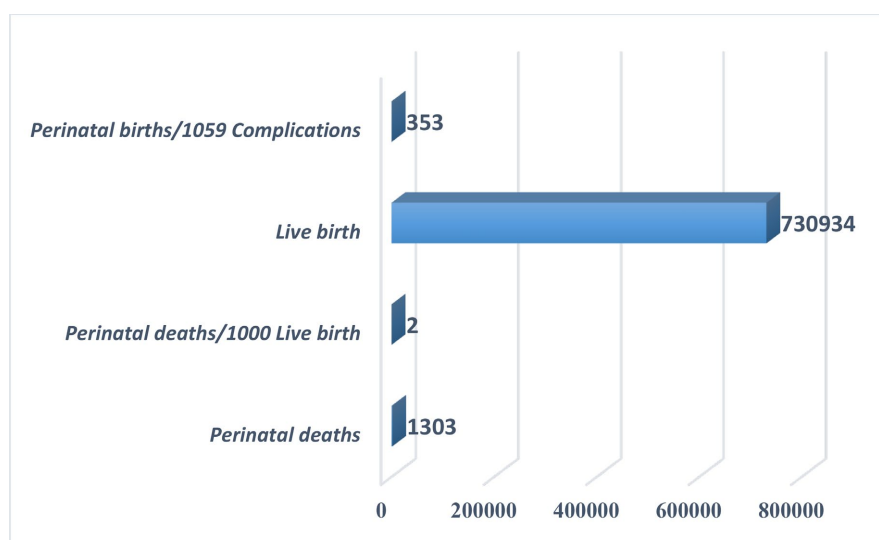


Figure 1. Perinatal mortality rate in Kasai Province from 2022 to 2024. Source: (DHIS2) and our surveys.

3.2. Factors Associated with Neonatal Deaths

A comparative analysis between deceased and surviving newborns highlights several factors associated with perinatal deaths. For each of the following criteria, the observed differences are statistically significant ($p \leq 0.05$): Low birth weight was the most pronounced factor (52.69% of deceased newborns weighed less than 2500 grams, compared to only 2.12% of survivors in this category). Rural areas showed a significantly higher mortality rate (93.20% of deaths occurred in rural areas, compared to 60.34% of survivors in these areas). Among premature infants (born between 31 and 36 weeks of gestation), the mortality rate was 44.48%, compared to 15.44% of survivors. The same difference was observed among premature infants born before 31 weeks of gestation. The absence of prenatal care negatively impacts survival (35.69% of babies who died were born to mothers who had not received any prenatal care, compared to 23.65% of survivors). Boys were more affected, representing 52.69% of deaths compared to 34.14% of survivors. Conversely, the presence of qualified personnel is a major protective factor: in this category, the survival rate rises to 66.15% (See **Table 2**).

Table 2. Factors associated with neonatal deaths among newborns interviewed in Kasai Province from 2022 to 2024.

Variables	Deceased n (%)	Near missed n (%)	OR (IC 95%)	P
Age of pregnancy				
<30 weeks	31 (8.78%)	0 (0.00%)	(–)	0.0000
30 to 36 weeks	157 (44.48%)	109 (15.44%)	5.21 (3.86 - 7.03)	
>36 weeks	165 (46.74%)	597 (84.56%)	1	
Âge de la mère				
<18 years	7 (1.98%)	19 (2.69%)	0.73 (0.30 - 1.75)	0.4742
18 to 40 years	340 (96.32%)	671 (95.04%)	1	
>40 years	6 (1.70%)	16 (2.27%)	0.74 (0.29 - 1.91)	0.5320
Skilled childbirth assistance				0.0000
No	300 (84.99%)	239 (33.85%)	11.06 (7.94 - 15.40)	
yes	53 (15.01%)	467 (66.15%)	1	
Antenatal care follow-up				0.0000
No	126 (35.69%)	167 (23.65%)	1.79 (1.36 - 2.37)	
Yes	227 (64.31%)	539 (76.35%)	1	
Twin pregnancy				0.4870
Yes	21 (5.95%)	50 (7.08%)	0.83 (0.49 - 1.41)	
No	332 (94.05%)	656 (92.92%)	1	
Place of origine				0.0000
Rural	329 (93.20%)	426 (60.34%)	9.01 (5.80 - 14.00)	
urban	24 (6.80%)	280 (39.66%)	1	
Birth weight				
<2500 g	186 (52.69%)	15 (2.12%)	50.16 (28.81 - 87.33)	0.0000
2500 à 3500 g	156 (44.19%)	631 (89.38%)	1	
>3500 g	11 (3.12%)	60 (8.50%)	0.74 (0.36 - 1.44)	0.3776
Sex				0.0000
Male	178 (50.42%)	241 (34.14%)	1.96 (1.51 - 2.55)	
Female	175 (49.58%)	46 (65.86%)	1	

3.3. Causes of Neonatal Deaths

The study of causes of death in the 353 deceased newborns revealed statistically significant differences ($p \leq 0.05$) with respect to dystocia (50.71% in deceased newborns vs. 30.45% in survivors), asphyxia (57.79% in deceased newborns vs.

27.20% in survivors), and neonatal sepsis (35.98% in deceased newborns vs. 18.98% in survivors) (See **Table 3**).

Table 3. Causes of newborn deaths in Kasai province from 2022 to 2024.

Variables	Deceased n (%)	Near missed n (%)	OR (IC 95%)	p
Dystocia				0.0000
Yes	179 (50.71%)	215 (30.45%)	2.35 (1.81 - 3.06)	
No	174 (49.29%)	491 (69.55%)	1	
Asphyxia				0.0000
Yes	204 (57.79%)	192 (27.20%)	3.67 (2.80 - 4.79)	
No	149 (42.21%)	514 (72.80%)	1	
Congenital malformations				0.8611
Yes	24 (6.80%)	46 (6.52%)	1.05 (0.63 - 1.74)	
No	329 (93.20%)	660 (93.48%)	1	
Neonatal sepsis/infection				0.0000
Yes	127 (35.98%)	134 (18.98%)	2.40 (1.80 - 3.20)	
No	226 (64.02%)	572 (75.35%)	1	

Multivariate analysis revealed a statistically significant association ($p \leq 0.05$) between perinatal death and the following seven factors: dystocia ($p = 0.0000$), asphyxia ($p = 0.0000$), lack of skilled assistance during childbirth ($p = 0.0000$), living in a rural area ($p = 0.0000$), low birth weight ($p = 0.0000$), and sepsis ($p = 0.0000$) (See **Table 4**).

3.4. Perceptions of the Levels of Responsibility for Perinatal Deaths

According to the testimonies gathered, responsibility for perinatal deaths is

Table 4. Adjustment for confounding variables.

Variables	AOR	95%	C.I.	Coefficient	S.E.	Z-statistic	p-value
Dystocia	3.7055	2.3236	5.9093	1.3098	0.2381	5.5005	0.0000
Gestational age	0.7445	0.3593	1.5427	-0.2950	0.3717	-0.7937	0.4274
Asphyxia	4.2884	2.6958	6.8217	1.4559	0.2368	6.1471	0.0000
Non-assistance during delivery	14.5754	8.8393	24.0338	2.6793	0.2552	10.5002	0.0000
Prenatal care follow-up	1.4182	0.8901	2.2599	0.3494	0.2377	1.4700	0.1416
Place of origin	10.1161	4.7752	21.4309	2.3141	0.3830	6.0418	0.0000
Birth weight	45.1315	17.4351	116.8248	3.8096	0.4853	7.8506	0.0000
Sepsis	3.0679	1.8157	5.1835	1.1210	0.2676	4.1889	0.0000
Sex	1.7085	1.1020	2.6487	0.5356	0.2237	2.3942	0.0167
CONSTANT	*	*	*	-2.9712	1.0439	-2.8461	0.0044

perceived as shared and multidimensional. It simultaneously involves three levels of actors: the community, the administration of healthcare facilities, and healthcare providers. This approach highlights the highly systemic nature of perinatal mortality, fitting directly within the analytical framework of the three delays (access to care, referral, and management).

At the community level, the interviews revealed major shortcomings related to pregnancy monitoring and the recognition of warning signs in newborns. The main factors identified were the absence or inadequacy of prenatal consultations (PNC), failure to follow medical instructions given during these consultations, and families' lack of awareness of danger signs.

The participants' accounts noted the following:

"Many new mothers don't recognize the warning signs their babies are showing. They bring them to the hospital late, reducing their chances of recovery."

"Some women don't attend prenatal appointments, and others don't follow the instructions they are given."

"Failure to follow instructions [...] prevents women from protecting their babies during birth. Often, no precautions are taken beforehand to minimize the risks."

The role of administrative management was also highlighted, particularly regarding logistics and material and human resources in the delivery room: stock-outs of essential medications and blocked access to the maternity ward's emergency kits; lack of equipment maintenance and absence of practical training on resuscitation equipment; and the constraints related to free healthcare (which is insufficiently funded) directly impact staff motivation and behavior.

The participants' testimonies indicated the following:

"The managers of the facilities often don't make available the supplies and equipment needed to resuscitate newborns with complications."

"Sometimes we lack an emergency kit in the maternity ward, even though there are medications available at the hospital's central pharmacy."

"We have plenty of equipment and resuscitation kits. When we receive them, there isn't a technician to teach us how to use them."

"Here, maternity care is free, yet the staff are poorly paid. This leads to negligence and mistreatment of women and their babies by the providers."

Clinically, the shortcomings of healthcare professionals are evident in their technical, ethical, and organizational aspects. Delays in initiating care, errors in assessing the severity of cases, and belated referrals to higher-level hospitals are all signs of inadequate clinical management. Attitudes perceived as harsh, capricious, or stigmatizing, which discourage women from returning or seeking timely care, point to a strained patient-provider relationship. Lack of planning (absence of individualized birth plans), excessive workloads, insufficient continuing education, and demotivation due to low wages are all contributing factors to poor working conditions and skills.

Participant testimonies are included below:

On planning and ethics:

“Some providers don’t develop a birth plan with women during prenatal consultations [...]. There’s a lack of professionalism among providers.”

“We providers are also too capricious. We waste a lot of time judging women [...] instead of starting care to save the distressed fetus. Other women don’t come back because of this behavior.”

On emergency management and referrals:

“The perinatal deaths recorded here are often cases referred late by Registered Nurses (RNs), with no fetal heart sounds.”

“The case is there, but the providers intervene late. The ignorance of some providers is also at the root of these deaths.”

On motivation:

“People say we work hard, but we aren’t paid enough. This is the root cause of neglect.”

In summary, perinatal mortality cannot be attributed to a single factor. It results from a chain reaction involving a combination of factors: community delays in seeking care (first delay), institutional management barriers (second delay), and weaknesses in the quality of clinical care within healthcare facilities themselves (third delay). Addressing this problem therefore requires cross-cutting interventions that simultaneously address community awareness, healthcare system financing, and continuing education for healthcare professionals.

4. Discussion

This study aimed to identify the factors associated with perinatal deaths among births that presented complications during the peri or postnatal period in the Health Zones of Kasai Province from 2022 to 2024.

The 1059 newborns included in this study presented characteristics frequently documented in research conducted in Africa. Among these newborns, 71.95% were born after a pregnancy of more than 36 weeks of gestation, 74.32% had a normal birth weight (between 2500 and 3500 grams), 2.46% were born to mothers under 18 years of age, and 71.29% of the mothers lived in rural areas and 39.57% were male (**Table 1**).

The proportion of deaths related to obstetric complications was 33.3%, representing a very high mortality rate in this very high-risk subgroup. This is a major discrepancy with the DHIS2 data, which reveals a perinatal mortality rate of only 2 deaths per 1000 live births. This discrepancy stems from the insufficient quality of the data encoded in DHIS2, which does not report all neonatal deaths occurring in healthcare facilities. The overall rate of 2 per 1000 from DHIS2 appears particularly low for the region. This may reflect underreporting of deaths at the community or hospital level within the health information system. However, our sur-

vey shows that in the event of complications, nearly one in three deliveries (33.3%) unfortunately results in perinatal death, highlighting the urgent need to strengthen the management of obstetric emergencies, which appears to be inadequate in this situation. A study conducted in 2018 in the Luebo Health Zone, located in the same Kasai Province, revealed similar results [26].

Several major explanatory factors were significantly associated with perinatal deaths in our study (**Table 3** and **Table 4**). These included rural living environment, gestational age (prematurity), low birth weight, male sex, lack of antenatal care, and clinical causes such as neonatal sepsis, asphyxia, and dystocia. Rural living environment and gestational age (prematurity) have already been identified as major determinants of neonatal mortality in the African context [5]-[7]. Low birth weight and prematurity are consistently cited as contributing factors in Africa [11] [16]. Male sex is also overrepresented and documented in other studies, as is the lack of antenatal care (ANC) [8]. The association revealed by infection and asphyxia is consistent with the findings of Berhanu B. *et al.* (2021) [16]. Access to healthcare is not always easy in rural areas, and the management of premature infants and medical emergencies is inadequate.

Although dystocia itself was not explicitly indexed in the literature reviewed, the established association between instrumental delivery and perinatal death suggests the underlying presence of dystocia as an indication for surgery. Conversely, confirming international evidence, our study reveals that the presence of a skilled birth attendant is associated with a reduction in perinatal mortality [21].

Our study found no association between maternal age and perinatal death (**Table 4**). Contrary to the literature, no significant association was found between congenital malformations and perinatal deaths. Two reasons may explain this: firstly, the low frequency of malformations recorded in our setting during the study period; On the other hand, prematurity and low birth weight often act as the main risk factors for lethality in infants with specific malformations (such as spina bifida), thus masking the direct effect of the malformation alone.

The qualitative results highlighted a shared responsibility for perinatal deaths, jointly involving the community, healthcare facility administration, and healthcare providers [27].

This systemic approach aligns with the findings of studies on perinatal mortality [27]. These findings reinforce the importance of implementing a death surveillance system (audits/reviews) that effectively integrates these three levels of analysis.

The results of this study can be extrapolated to other similar contexts. The organization of the healthcare system and the structural constraints observed in Kasai Province are quite comparable to those found in other provinces of the DRC and in many resource-limited countries.

This study was not without its limitations. Data collection relied on routine registers, the quality of which depends on the completeness and rigor of the service providers. This limitation was mitigated, however, by cross-referencing with secondary sources (partograms, death review forms) and by triangulation with participants' perceptions. The scarcity of published studies specific to Kasai Province

limited direct comparisons with the local past. This constraint was partially offset by the use of data from recent national surveys.

5. Conclusions

Perinatal mortality remains a major public health problem in Kasai Province. This study highlights the persistence of largely preventable causes of death, revealing systemic failures at both the community level and within healthcare facilities.

The analysis identified key factors associated with perinatal deaths. Major risk factors included prematurity, low birth weight, male sex, rural birth, lack of skilled assistance during delivery, and inadequate antenatal care (ANC). The predominant medical causes were dystocia, perinatal asphyxia, and neonatal sepsis. Combating this scourge involves three interdependent levels of responsibility (the community, healthcare facility administration, and healthcare providers), which must be considered when strengthening the maternal mortality surveillance system.

Conflicts of Interest

The authors declare no conflicts of interest.

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