SHORT COMMUNICATION

African Journal of Ecology 🐾 **WILEY**

Persistence of wild felids after a protracted civil war in Quiçama National Park and Quiçama Game Reserve, Angola

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1 | INTRODUCTION

Wild felids are globally vulnerable to increasing anthropogenic pressures, with some populations severely declining in many areas of their distribution range (Bauer et al., 2015; Durant et al., 2017; Terraube et al., 2020). Many felids, especially larger species are mostly restricted to protected areas, and their persistence is strongly dependent on adequate protection. However, profound limitations in operating funds and management capacity create a situation in which felid populations are strikingly depleted inside many protected areas, especially in Africa (Lindsey et al., 2018) or their current status is too poorly known to assess the prospects for long-term persistence.

The Quiçama National Park and adjacent Quiçama Game Reserve, Angola, are a striking example of these challenges. One of the most important protected areas of Angola, it hosted abundant and widespread wildlife including five felid species until the 1960s–1970s (Huntley, 1973; Teixeira et al., 1967). Carnivores were once abundant but were reduced in the 1960s by a predator removal campaign that employed strychnine-laced carcasses (Huntley, 2017). By the onset of the civil war, carnivores were significantly depleted but species still believed to occur included the medium-large species lion *Panthera leo*, leopard *P. pardus*, serval *Leptailurus serval*, cheetah *Acinonyx jubatus*, spotted hyaena *Crocuta crocuta* and African wild dog *Lycaon pictus* (Huntley, 1973; Teixeira et al., 1967). However, the intermittent 27-year Angolan civil war (1975–2002) combined with very low management presence even during peaceful periods facilitated extensive overexploitation of wildlife, inducing population collapse of most mammals in the park area (Braga-Pereira, Peres, et al., 2020). Post-war recovery of wildlife has been severely limited by poor governance, endemic poverty and very widespread availability of military firearms used for hunting (Braga-Pereira et al. 2020).

Until recently, these same constraints have precluded undertaking research in Quiçama. Aside from anecdotal reports, there are few published data on the presence or status of most large mammals including felids since the beginning of the Angolan civil war. Accordingly, we undertook the first rigorous attempt to collect data on felids since 1975. Literature increasingly suggests the use of local ecological knowledge (LEK)-based methods for carnivore inventories, as these methodologies are accurate, cost- and time-effective and can rapidly inventory large areas (Braga-Pereira et al.,

2021; Madsen et al., 2020; Mbise et al., 2020; Petracca et al., 2018; Rafiq et al., 2019). Thus, using LEK-based methods combined with opportunistic first-hand observations, we provide here an update on the presence and distribution of lion, leopard and serval in Quiçama National Park and Quiçama Game Reserve. We also provide information on the level of human hunting of felids and their conservation prospects in the protected areas.

2 | MATERIAL AND METHODS

2.1 | Study area

Quiçama National Park and Quiçama Game Reserve (hereafter collectively referred to as Quiçama) consist of two contiguous protected areas encompassing 9960 Km² with a fenced 'Special Conservation Area' of 99.6 km² established for reintroduction efforts of herbivores during the 2000s.

Currently, Quiçama is occupied by almost 9000 people. Although this local population is not legally permitted to occupy the two protected areas, they have lived in the area prior to park delimitation. Subsistence hunting of non-endangered species is permitted in Angola (Law No. 6/17 of January 24) although it is not legal inside protected areas. Nonetheless, hunting by residents in Quiçama is very prevalent.

2.2 | Data acquisition and compilation

Data were collected from January to April 2017. Interviewees were selected using the snowball sampling technique (Bailey, 1994), in which interviewed experts indicate additional candidates, repeated until the candidate pool is exhausted. Previous personal contact between FB-P and key interviewees (from January to July 2014) established a relationship of trust that reduced potential problems, for example the researcher being perceived as law enforcement. We selected 123 interviewees (120 men and 3 women), comprising 116 local hunters and 7 park rangers, ranging in age from 20 to 80 years old. All interviewees had lived or worked in the park for at least 15 years, ensuring they had been living in the study area since the civil war period.

We conducted structured interviews with an illustrated checklist, which provided visual stimulation with drawings of species potentially present in the study area. We also included images of species that have never occurred to verify interviewees' competence at identifying species. Although African wildcat *Felis lybica* is definitely present (Groom et al., 2018), our questionnaire focused on medium-large mammals (including non-carnivores, Braga-Pereira et al., 2020) and we did not collect location data on this species.

We asked each interviewee the date of the most recent felid observation and, if it occurred in the last 5 years, to indicate the observation location on a map (Ernoul et al., 2018). We asked interviewees their opinion of felid abundance before, during and after the civil war.

Interviewees who perceived that felids had declined were asked to name the drivers of declines. For hunters, we additionally asked i) their motivation for hunting felids; ii) their revenue from selling skins (the primary product sold); iii) the date of the most recent felid killing; and iv) how often each species was killed, either the number killed per year or the total number killed since he/she started hunting. We calculated an annual kill rate of each species for each interviewee. We opportunistically recorded physical evidence of felids including body parts (skins, skulls in villages, etc.), tracks and direct observations.

The capture frequency was calculated annually, so if the capture frequency occurs at intervals greater than 1 year, the frequency value will be less than 1.

2.3 | Ethics approval

This research was approved by the i) Brazilian National Health Council (Resolution 466/12), through the Research Ethics Committee of the Universidade Federal da Paraíba (licence number 59846816.3.0000.5188); ii) Environmental Ministry of Angola (148INBAC.MINAMB/2016); iii) municipal administration of Quiçama (licence number 017/GAB.ADM.MQ/2017); and by the iv) leaderships of all sampled villages. An informed consent form was given to the interviewee, stating the purpose of the interview and ensuring the interviewee's anonymity, so after having the informed consent from signed, the interview was started.

3 | RESULTS AND DISCUSSION

Of 123 interviewed people, 94.3%, 83.7% and 59.3% reported seeing (alive or dead) at least one serval, leopard and lion, respectively, in her/his life. No one definitively reported seeing cheetah, other than general references to the species being present before the war. The most recent observation of serval and leopard occurred in the preceding 5 years for most people (85% and 76% respectively). Given our data present only the most recent year in which felids were seen or killed, they are not indicative of population trends of cats. From these data, we can only conclude that more people reported seeing servals and leopards in recent years than lions which reflects the relative scarcity of the latter but tells us little about changes over time. For lion, the most recent observation by most (56%) interviewees occurred 20–49 years preceding the interviews. Eight people reported seeing a lion in six locations in the preceding 5 years, which represents 13% of the total reported lion observations (Table 1).

Regarding the distribution of records, for the period 2012–2017, interviewees from all regions of Quiçama reported seeing

serval and we also collected opportunistic observations for serval throughout Quicama, which agrees with Groom et al. (2018). Leopard reports for this period (sighting and killing by the interviewees) were restricted to the south of the park, except for two recent sighting reports near the Special Conservation Area. Our opportunistic observations follow a similar pattern, with the only physical evidence (tracks, sightings of live individuals, skin and skulls) of leopards occurring in southern Quiçama (Figures 1 and 2). All lion reports from 2012 to 2017 occurred in the south of Quiçama (Figure 2). We did not record lions through opportunistic observation.

Overhunting was the main reason associated with felid declines and most (n = 86) hunters reported killing a wild felid at least once. For servals and leopards, 60% and 31% of respondents, respectively, reported cats being captured unintentionally in snares and leg-hold ('gin') traps set for herbivores. However, interviewees also reported intentionally killing felids related to i) depredation of domestic goats and chickens, as well as pilfering of fish from drying racks in the case of servals; ii) because felids are seen as competitors for wild prey species sought by hunters; and iii) to sell their parts, mainly the skin (Table 2), and sometimes bones, canines, claws and meat in the case of leopard. Regardless of whether

TABLE 1 Record of the most recent year that each interviewee reported seeing or killing *Leptailurus serval*, *Panthera pardus* and *Panthera leo*

| Year | Leptailurus serval | | Panthera pardus | | Panthera leo | |
	Sightings (live animals)	Killing	Sightings (live animals)	Killing	Sightings (live animals)	Killing
2017	41	4	19	5	2	1
2016	16	12	17	7	1	0
2015	15	2	20	5	0	0
2014	7	1	11	4	1	1
2013	6	2	9	1	2	2
2012	4	0	1	3	2	0
2007–2011	16	5	10	4	8	3
2002–2006	6	3	5	4	8	2
1997–2001	2	4	3	1	8	2
1992–1996		10	2	2	6	1
1987–1991		12	1	1	8	4
1982–1986	1	10	2	3	6	5
1977–1981		7	1	1	10	6
1972–1976	1	7	2		10	7
1967–1971		6			1	4

Note: Data are presented in 5-year increments for 1967–2011 and annually thereafter.
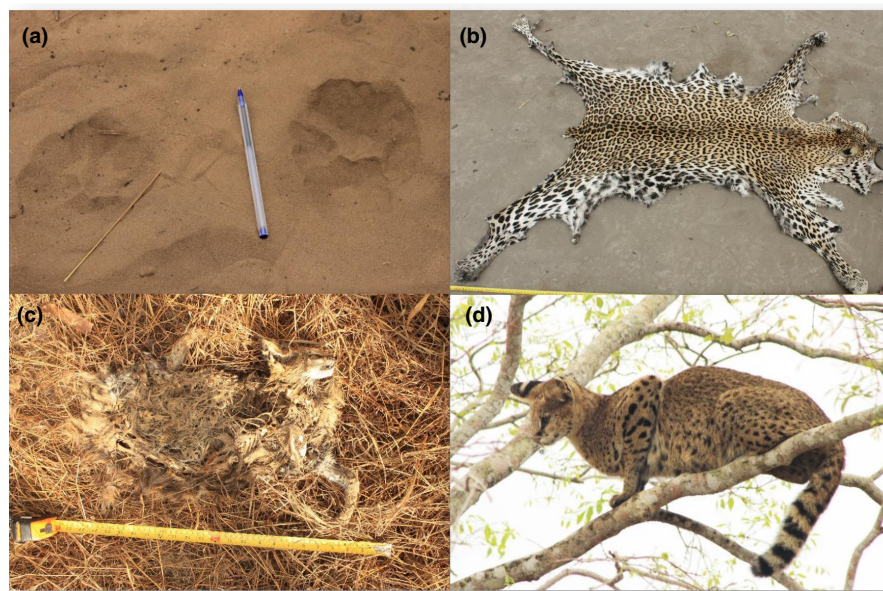

FIGURE 1 Physical evidence of felids in Quicama National Park and Quiçama Game Reserve in Angola. (a) Leopard track. (b) Leopard skin in possession of local hunter. (c) Road-killed serval. (d) Adult serval ('servaline' form) in northern Quicama NP. The individual was observed resting in a tree prior to being approached; it had not been chased there by dogs or people (photographs FB-P)

capture was accidental or intentional, felids were always killed when found in traps and the parts sometimes sold.

The average of annual catch frequency per hunter between 2007 and 2017 was higher for serval and leopard, than for lion (Table 2). Most hunters reported that the peak in killing servals and leopards for skins occurred between the 1970s and 1990s when demand was high. According to interviewees, demand waned as the fur industry shifted to imitation furs (international bans on spotted cat skins implemented during the 1970s were the actual underlying factor, see Nowell & Jackson, 1996) and prices plummeted. Hunters reported significant declines in killing cats for their skins as a result. Nonetheless, there is still a clear present market for felid skins which are still sold whenever one is killed. Lion killing peaked during the same period of high hunting for spotted cat furs although mainly for conflict retaliation, as lions were commonly perceived as a threat to livestock, as well as a competitor for wild prey species sought by hunters. The use and local manufacture of large leg-hold traps is a relatively recent development and were associated with a recent records in killing leopards (Table 1) according to interviewees. These traps are now prevalent in the south of Quicama, specifically targeting leopards for their skins as well as being deployed to capture other wildlife. Despite the high monetary value attributed to lion skin, it was rarely captured recently (Table 2), presumably because the population has been very low for a long time.

Large felids have undergone a significant decline in Quiçama. Both the cheetah and lion are likely extinct or possibly reduced to a few individuals in the case of the latter. Neither species was recorded during a camera-trap survey of Quiçama following our fieldwork, in 2017 (Groom et al., 2018). All recent (2012–2017) interviewee reports of lions were of solitary individuals and we found no evidence for breeding. Transients from eastern Angola may explain our records, although the presence of lions is uncertain everywhere in the country except for a small population in the Luengwe-Luiana complex, approximately 1000 km away in the south-east of the country (Beja et al., 2019). Most recent reports of lions come from a mostly roadless section in southern Quiçama, particularly Omba, Morro Liso and Caleba (Figure 2). Further surveys for lions focusing on these areas would be valuable to establish whether the species is extant.

Leopards have fared somewhat better. They appear to be largely absent from the northern half of Quiçama, but there are indications of a relatively healthy population in the park's south-east. This is reflected in data on other species where, except for the fenced Special Conservation Area, most medium-large mammals now exist in the more remote and less populated south-east (Braga-Pereira, Peres, et al., 2020). The north region is open savannah with a more developed road network where use of rifles and vehicles makes ungulate hunting and transport to markets particularly efficient (Braga-Pereira et al., 2020). Its greater proximity to Angola's capital Luanda intensifies the problems of access and demand for wild meat from residents outside the area.

Bushmeat hunting is pervasive among the human population of Quiçama, is inter-generational and is driven by local needs as well as demand from Luanda. It has severely depleted available prey for large felids and is undoubtedly the key driver in population declines. This is compounded by targeted and opportunistic hunting of cats. Although few hunters view felids as the major motivation for hunting in Quiçama, they are always killed when opportunity presents and the very widespread prevalence of hunting across the system translates to steady pressure from direct anthropogenic mortalities. Rapidly and drastically curtailing this hunting is essential if extant felids are to persist and for any future prospect of recolonisation or restoration of lions and cheetahs.

In the immediate term, we recommend a significant increase of ranger presence and effort in the south of Quiçama. Its greater conservation value arises mostly from its remoteness, closed-canopy forest habitat which is not favoured by local hunters and lower human residency rather than a systematic anti-poaching presence which is currently extremely limited. Focusing on securing the south would elevate protections for Quicama's remaining leopards while also protecting relict populations of other large mammals including buffaloes and elephants. Concurrently, it is urgent to identify pathways that promote long-term food security and employment opportunities among local people. Quicama's proximity to Luanda creates significant potential for tourism to become a major industry, with concomitant potential benefits in job creation directly linked to wildlife conservation. However, that is a long-term prospect even for relatively intact ecosystems and it will require many years of such investment to take hold in Quiçama. In the meantime, a collaborative management agreement with a private partner focused on improving management and anti-poaching capacity may be desirable (Baghai et al., 2017). Such partnerships are increasingly common and lend themselves to rapid implementation compared to large-scale commercial investments in large and depleted ecosystems such as Quiçama. Whatever the collaborative management formula, we

FIGURE 2 Map of Quiçama National Park (demarcated by the green line) and Quiçama Game Reserve (demarcated by the orange line) in Angola. The blue and red polygons indicate locations where leopards and lions, respectively, were reported in the past 5 years. One lion sighting was reported by more than one interviewee. Locations from where lions were reported are numbered: 1. Omba, 2. Morro Liso, 3. Baixa do Dondo, 4. Caleba, 5–6. Quilonga. Serval locations occurred throughout the park in a polygon analogous to the park border and are not shown. Solid yellow triangles indicate the surveyed townships, which encompassed more than one human settlement. Triangle sizes are proportional to the population size of the townships. Green and greyish—orange background areas represent forest and savannah environments, respectively. Map generated using ArcGIS 10.3.1; Datum: WGS84. Source: ESRI, Edited in Adobe Photoshop and Elaborated by Ana Caroline Imbelloni and Franciany Braga-Pereira in July/2021
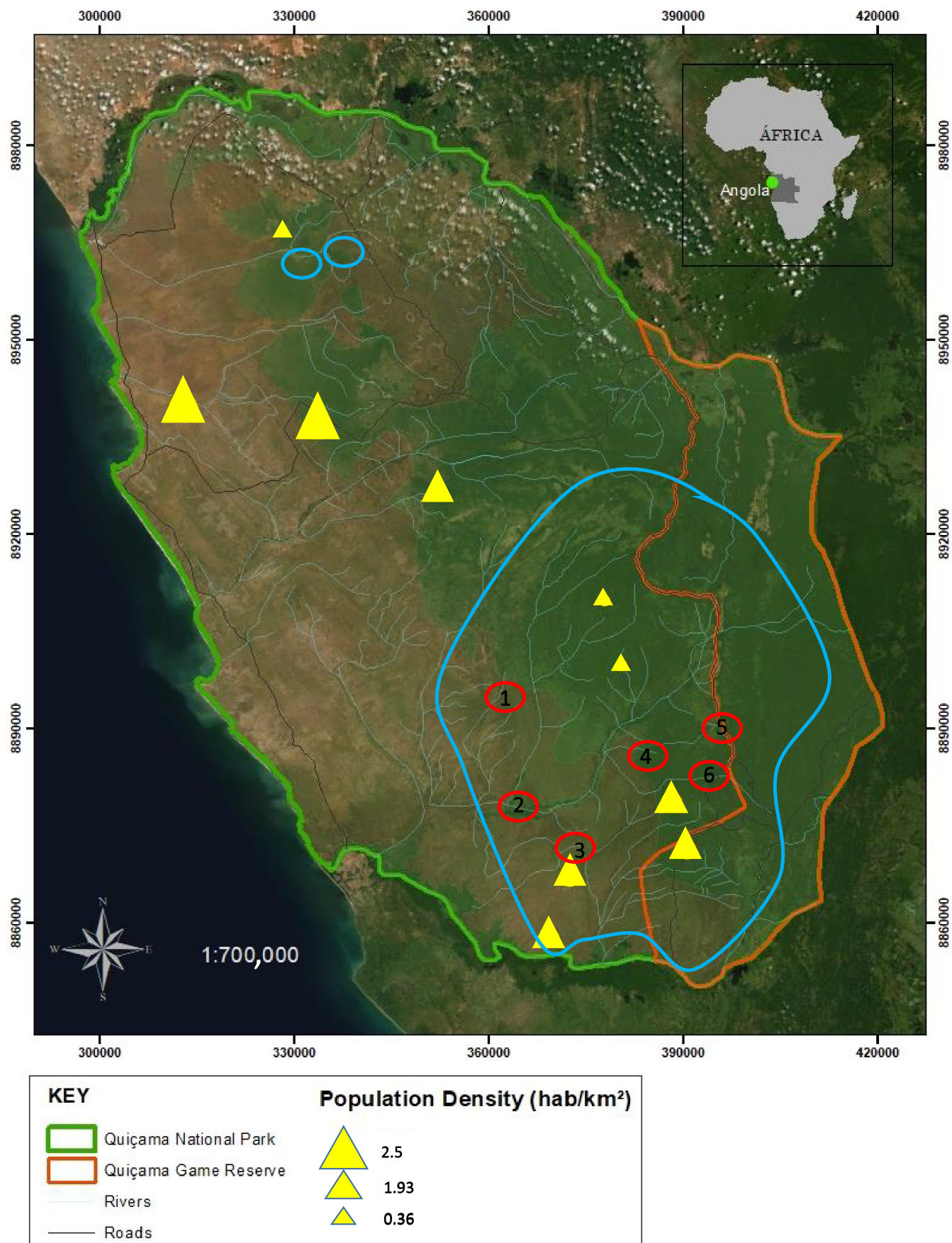
KEY

Population Density (hab/km²)

— Quiçama National Park

— Quiçama Game Reserve

Rivers

— Roads

2.5

1.93

0.36

TABLE 2 Interviewees' information and opportunistic observations of *Leptailurus serval*, *Panthera pardus* and *Panthera leo*

Species	Interviewees' information												First hand physical evidence (number of records) collected in 2017		
	Number of interviewees who reported declining field abundance since the start of the civil war	Perceived drivers of depletion (response rate)[a]			Number of hunters reporting killing cats	Motivation for killing (response rate)[b]		Skin value (USD)[c]	Number of hunters killing cats 2007–2017	Annual catch frequency per hunter, 2007–2017			Tracks	Sightings (live individuals)	Body parts (skin or skulls)
		Migrated looking for prey	Migrated to escape hunting	Overhunting		Conflict retaliation	Commercial trade			Average	min	max			
Leptailurus serval	70	0.0	17.1	100	86	100.0	53.5	20	26	0.54	0.03	7	9	2	4
Panthera pardus	98	18.4	27.6	99	41	34.1	68.3	400	29	0.2	0.03	1	11	1	4
Panthera leo	103	39.8	27.2	55	38	81.6	28.9	400	9	0.07	0.02	0.19	0	0	0

[a]Response rate calculated from all responses (hunters and rangers, N = 123) who reported perceiving decline in cats' abundance.

[b]Response rate calculated from response of hunters only (N = 115).

[c]Dollar values based on 2017 conversion rate, USD1:AOA165.

conclude by emphasising that the window for securing Quicama's wildlife and the well-being of its human inhabitants is closing very rapidly.

CONFLICT OF INTEREST

We declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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