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Feasibility of a Contact Tracing Smartphone Application for Febrile Patients in Cambodia

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Background

- **GPS data from smart devices** have been used across disciplines to **supplement verbally-collected location history**[1]. These data can exist as Exchangeable Image File (EXIF) metadata from **geotagged images from a smartphone camera.**
- We developed a **novel EXIF-based smartphone application** for enhanced contact tracing as part of ongoing **metagenomic febrile disease surveillance in Cambodian patients** (n=2559) to complement existing verbal location data collection in patients with highly transmissible pathogens (Figure 1)[2,3].

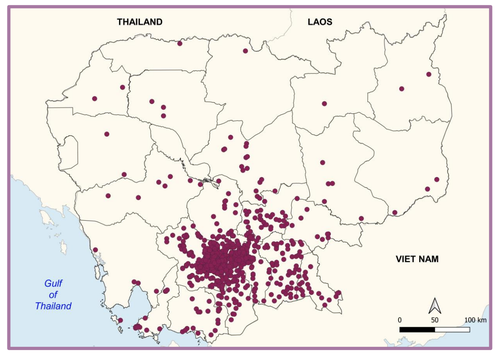

Fig 1. Home coordinates for 2559 Cambodian study participants based on verbal enrollment questionnaire.

Methods

- We developed the Android application **CoorFamily** to extract **locational EXIF data from photos taken within the last 10 days**. CoorFamily is available on the Google Play Store in English and Khmer (Figure 2).
- We tested its implementation in a **10-week pilot study involving 713 volunteers** at 4 enrollment sites throughout Phnom Penh and Kampong Speu province.
- As part of the standard enrollment questionnaire, **we verbally collected past-10-day travel history.** For the pilot, we added questions regarding participant phone compatibility and willingness to upload data. In pediatric cases, the caregiver's phone was used.

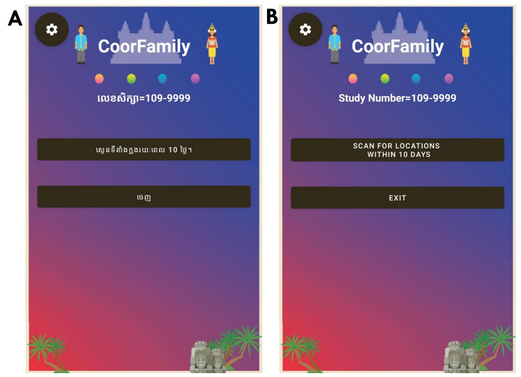

Fig 2. CoorFamily user interface in **(A)** Khmer and **(B)** English.

Conclusions

- The CoorFamily application extracts **detailed past-10-day geolocational data** from smartphones **without adding significant time or difficulty** to the enrollment process.
- EXIF location data derived from images taken on smartphone cameras **supplement memory-dependent location data collection** to better inform contact tracing efforts.
- Alternative sources of location data (e.g., Google accounts) were problematic due to inability to recall user information; **third-party de novo approaches like CoorFamily's are more practical** in this study setting.
- CoorFamily may be better suited for use in **adult populations** with a **higher proportion of Android users and consistent smartphone camera users.** Pediatric data may indicate unreported movement due to asynchronous behavior between caregivers and patients.

Results

- The primary obstacles we encountered were **phone incompatibility** (iPhones, non-smartphones, or no phone) and **lack of photos with locational metadata** (no photos to upload or photos with no EXIF location data [e.g., screenshots, attachments]) (Figure 3A).
- Most participants with no data reported **no smartphone camera use within the previous 10 days.**
- Notably, **of patients with compatible phones, 99.0% agreed to use the application;** privacy concerns did not pose a major obstacle to application implementation.
- In all 10 cases in which geolocational data were successfully extracted, **patients verbally reported not having left home in the previous 10 days.** The **closely clustered points** (e.g., light blue) **support this statement,** while more **widely-spread points** (e.g., teal) **suggest unreported travel** (Figure 3B).

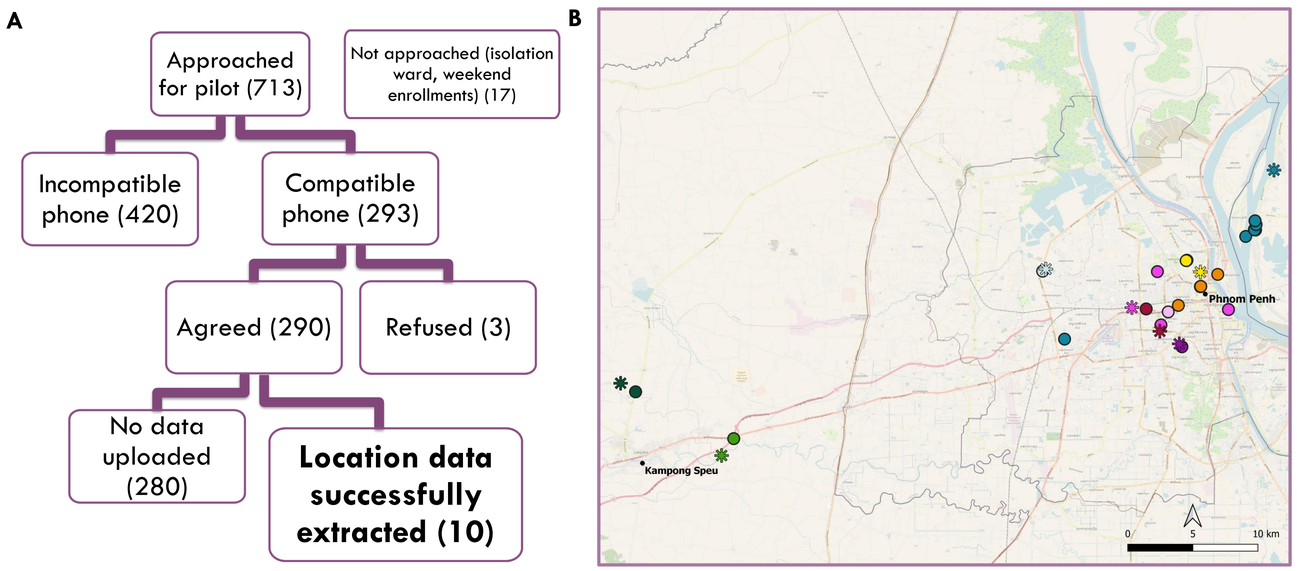

Fig 3. (A) Outcomes for 713 pilot study participants; **(B)** Verbally-reported home coordinates from enrollment interview (asterisks) and CoorFamily app geolocational data (solid circles) for 10 cases in Phnom Penh and Kampong Speu province.

References

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[3]Yek C, Pacheco AR, Vanaerschot M, *et al.* Metagenomic pathogen sequencing in resource-scarce settings: Lessons learned and the road ahead. *Frontiers in Epidemiology.* 2022;2. doi:10.3389/fepid.2022.926695