When are we operating on kids?

A potentially simple intervention to improve outcomes in developing countries.

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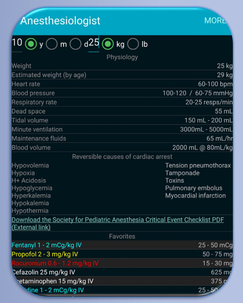
Introduction

- According to the Lancet Commission on Global Surgery, over 5 billion people have deficient access to basic surgical and anesthetic care.
- The rapid global adoption of mobile health (mHealth) smartphone apps by healthcare providers provides opportunities to study global medical practice patterns, track access to care, and disseminate best practice information.
- App analytics, combined with in-app demographic surveys, can provide powerful tools for the collection of data in these areas.

Methods

- We studied users of a free anesthesia calculator app used in nearly every country in the world.[1] (Screenshot and Fig 1 global app penetration, right)
- We combined traditional app analytics with in-app surveys to collect user demographics and feedback. Chi-square tests were used for statistical comparison, using Holm's method to correct for multiple comparisons.



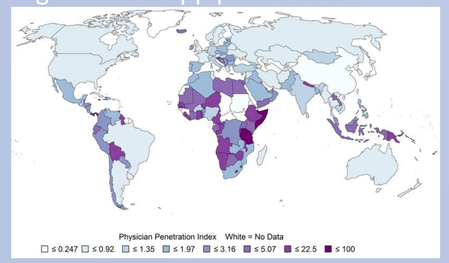
Results

- Data on ~617k patient age entries from 48,034 subjects in 212 countries.
- Most app uses were associated with the care of pediatric patients: ~147k (24%) of patient records were less than one month old, and ~465k (75%) were less than twelve years old (Table 1).
- We observed significant differences in age of the patients for which the app was consulted as a function of country income level. Specifically, the proportion of neonates, infants, and toddlers was higher in lower income countries (Table 1).
- We also observed significant differences in the hour of the day when the app was used; for neonates, infants, and toddlers, app uses were observed at a significantly higher rate in the evenings and at night in lower income countries.
- In particular, the app was consulted at a substantially higher rate for neonatal patients in lower middle income countries. Except for low vs lower-middle income in all categories, all pairwise comparisons were statistically significant at the 0.005 significance level.

	Low income		*Lower middle income*		*Upper middle income*		*High income*		*Total*	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Neonate (<= 1 mo)	4317	25.5%	49184	27.0%	44641	21.6%	48804	23.1%	146946	23.8%
Infant (1 mo - 1 yr)	2827	16.7%	25819	14.2%	28506	13.8%	23157	11.0%	80309	13.0%
Toddler (1 - 3)	1845	10.9%	18422	10.1%	22252	10.8%	24940	11.8%	67459	10.9%
Child (3 - 12)	3962	23.4%	46000	25.2%	57942	28.1%	62147	29.5%	170051	27.6%
Teenager (12 - 18)	551	3.3%	6184	3.4%	7158	3.5%	7557	3.6%	21450	3.5%
Adult (> 18)	3435	20.3%	36668	20.1%	45976	22.3%	44393	21.0%	130472	21.2%
Total	16937		182277		206475		210998		616687	
Proportion of Total Cases By Income	2.7%		29.6%		33.5%		34.2%			

Table 1: Proportion of cases by country income level and by age of patient.

Fig 1: Global app penetration.



Conclusions

- Country income level appears to be an important predictor of the use of mHealth clinical decision support.
- This may suggest higher need for decision support in the care of this vulnerable population.
- There is good evidence that nighttime procedures are associated with increased complication rates and reduced efficiency.[2–4] The increased rate of evening and nighttime procedures in lower income countries is potentially a very easy target for intervention in improving outcomes.

Table 2: Time of day that the app was consulted for care of neonatal, infant, and toddler age patients.

	Day 6AM - 5 PM		*Evening 5PM - 8PM*		*Night 8PM - 6AM*	
	N	%	N	%	N	%
Neonate (< 1 mo)						
Low income	2908	67.4%	739	17.1%	670	15.5%
Lower middle income	28875	58.7%	8841	18.0%	11468	23.3%
Upper middle income	30578	68.5%	7116	15.9%	6947	15.6%
High income	34327	70.3%	7654	15.7%	6823	14.0%
Infant (1 mo - 1 yr)						
Low income	1853	65.5%	500	17.7%	474	16.8%
Lower middle income	16487	63.9%	4514	17.5%	4818	18.7%
Upper middle income	19535	68.5%	4413	15.5%	4558	16.0%
High income	16159	69.8%	3573	15.4%	3425	14.8%
Toddler (1 - 3)						
Low income	1249	67.7%	320	17.3%	276	15.0%
Lower middle income	12363	67.1%	3026	16.4%	3033	16.5%
Upper middle income	16228	72.9%	2935	13.2%	3089	13.9%
High income	18679	74.9%	3267	13.1%	2994	12.0%

References

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