4th March, 2023

School of Science and Engineering, LUMS Dr. Basmaa Ali (Harvard) Dr. Agha Ali Raza (LUMS)

MIGRAINE PREDICTION ENGINE

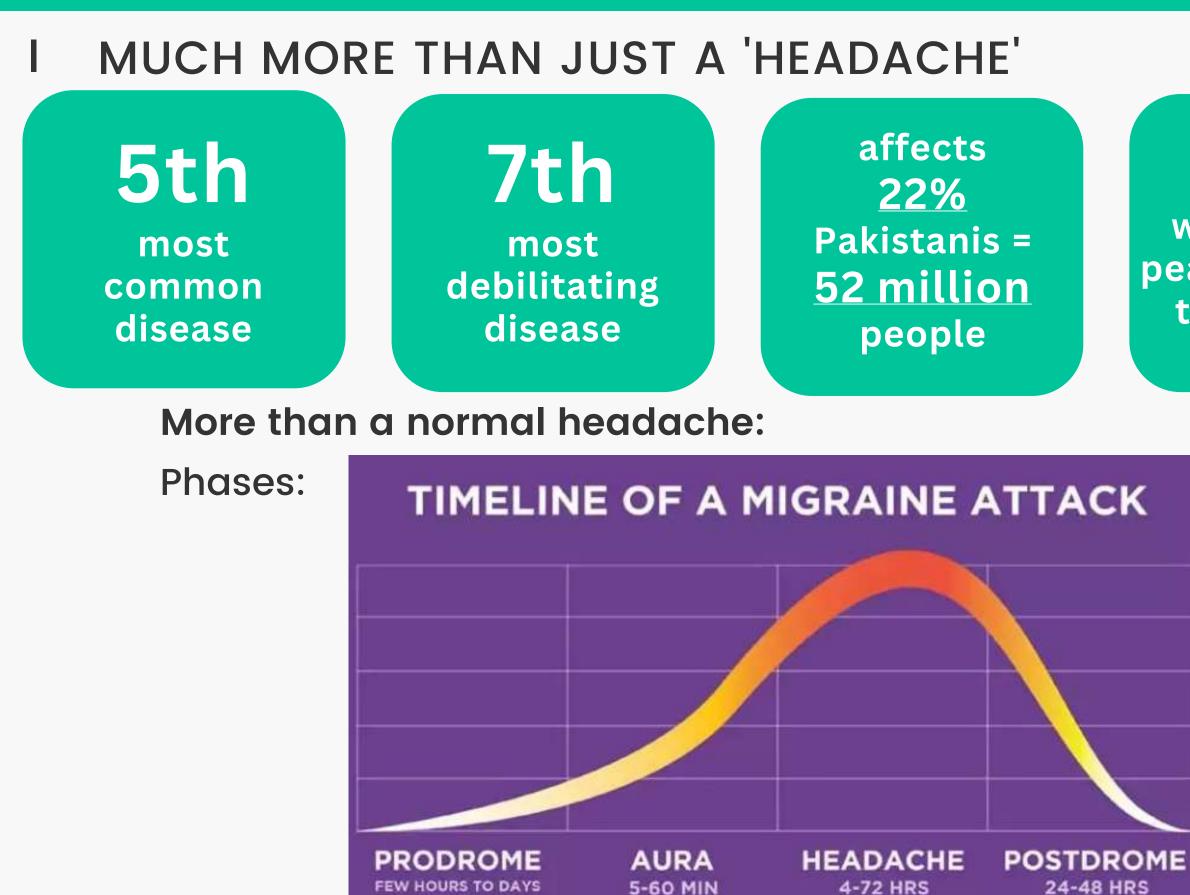
ADVISORS

STUDENT Sheza Munir



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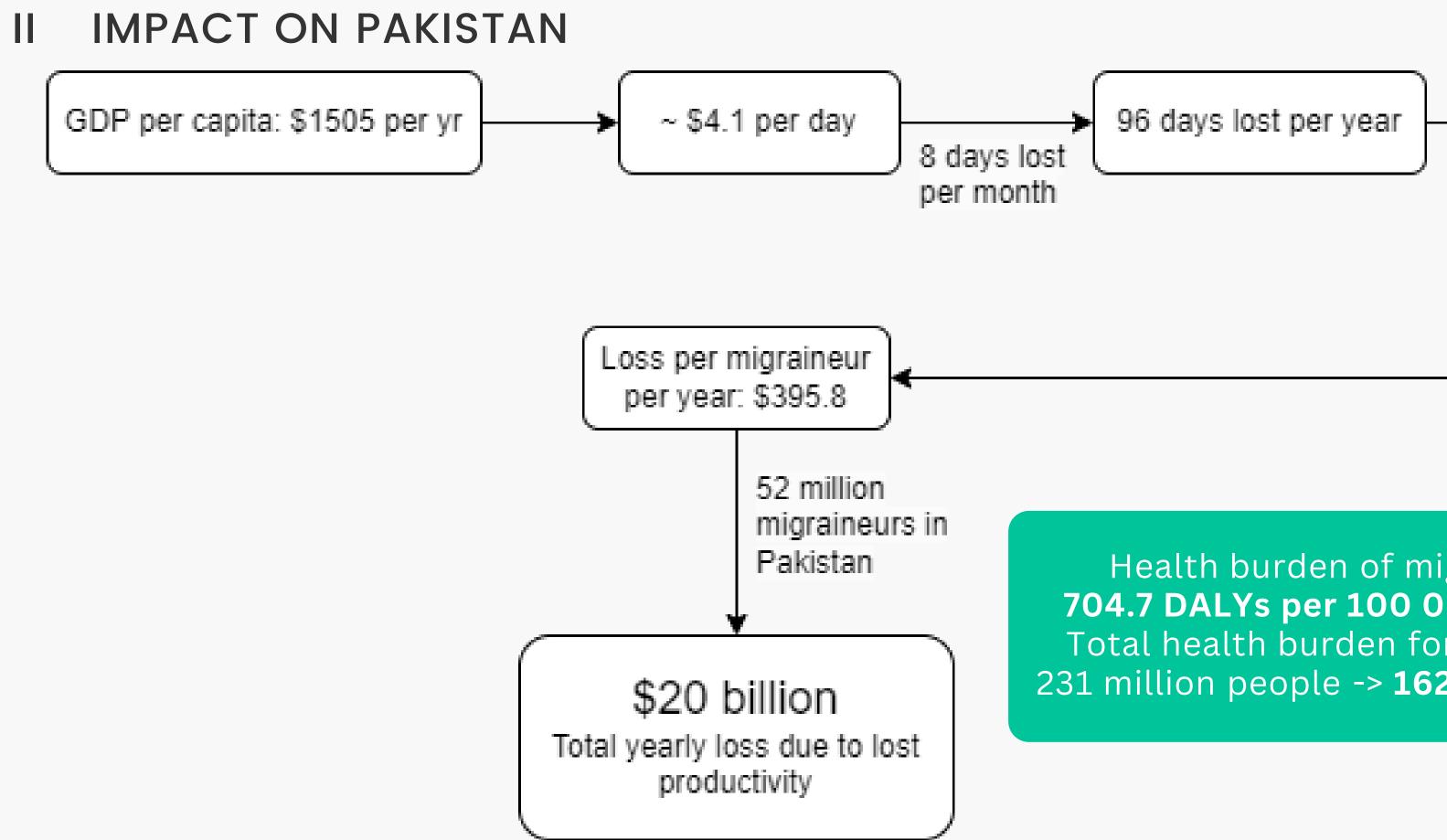


Our survey of **106 migraineurs** shows that the inability to plan their life is as distressing as the pain and disability of the actual attacks.

2/3 women in the peak productive time of their lives

90% are unable to function during an episode.

Each episode lasts ~48 hours 4.2 episodes per month ~8 days lost every month



Accounting for healthcare expenditure, the cost is much higher in reality!

Health burden of migraines: 704.7 DALYs per 100 000 people Total health burden for Pakistan: 231 million people -> 1627857 DALYs

III CURRENT SOLUTIONS

Preventatives and abortives

preventative: low compliance rate

abortive: low efficacy

CURRENT SOLUTIONS

Statistics do not

apply to people

group stats ≠ individual's stats

migraine map: individual and dynamic

mHealth solutions currently have low accuracy

put the onus of tracking on patients

current: 65% with digital diaries using biomarkers: 84%

Migraine episode = Failure of the system

an uncaught migraine episode is a

treatment failure

IV OUR GOAL

"Develop a personalized migraine prediction and prevention tool."

OUR SOLUTION V

- Combines digital diary data with physiological biomarkers from wearables, and collects weather data from NOAA.
- Takes the onus of tracking off patients
- Each migraineur has an individual migraine map, our solution creates personalized migraine predictions.

3 STREAMS OF DATA:

Biomarkers

- Heart rate
- Galvanic skin response (EDA)
- Body temperature
- Movement (behavioral)

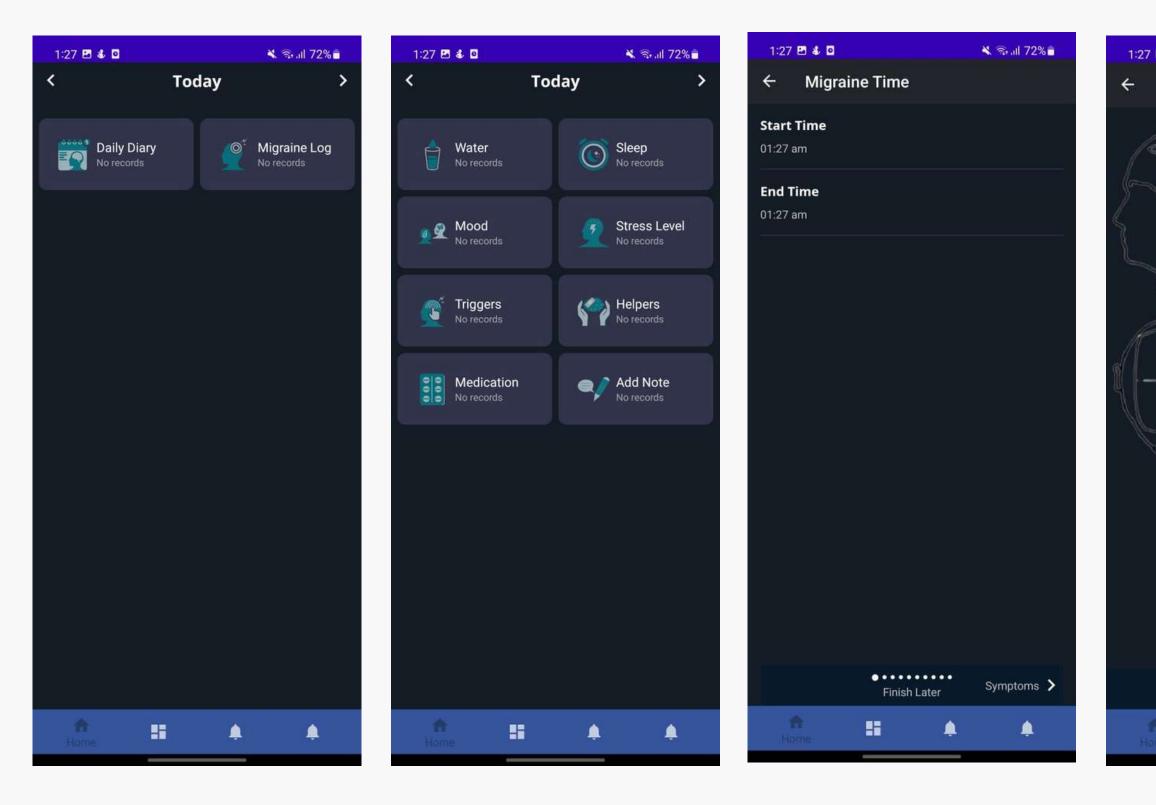
Digital Diary

- Sleep
- Stress score
- Migraine events
- Stressors, helpers
- Location

Weather

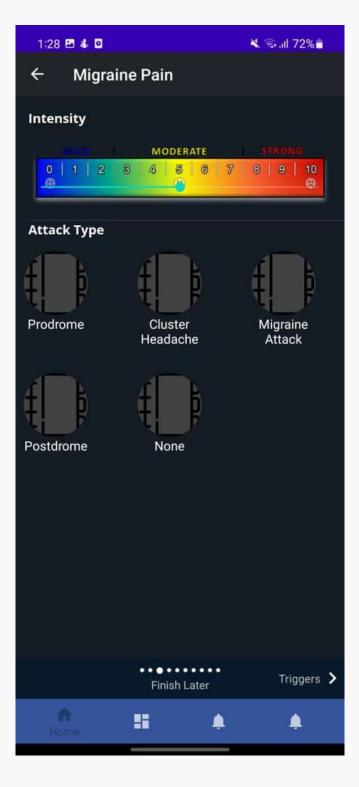
- Temperature
- Atmospheric pressure
- Humidity
- Storms
- UV index
- Cloud cover
- Lightning

VI TRACKING BY THE DIGITAL DIARY



Features of the application: dark color pallete, no sounds, low contrast.

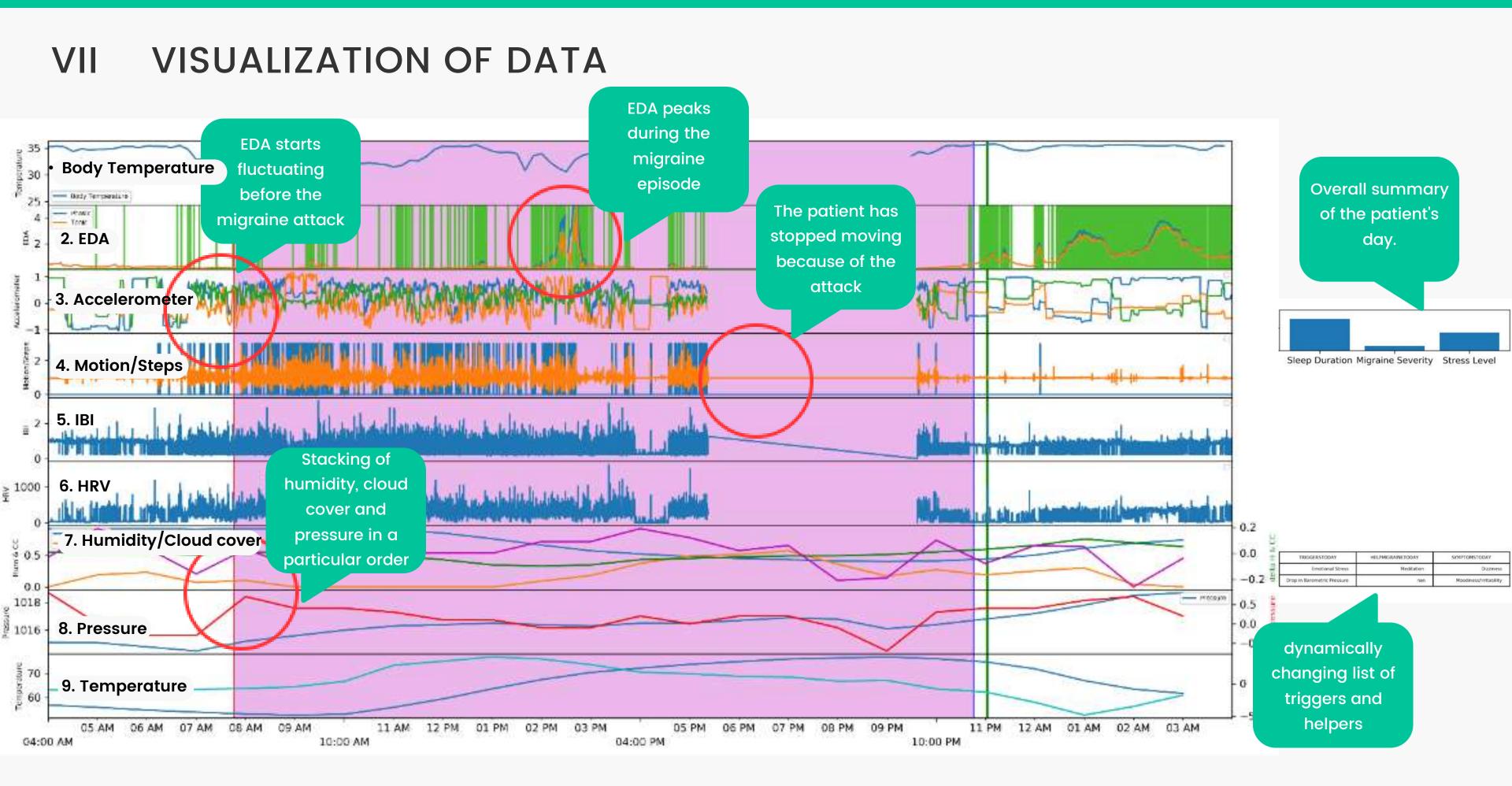




WHAT WE'RE WORKING WITH

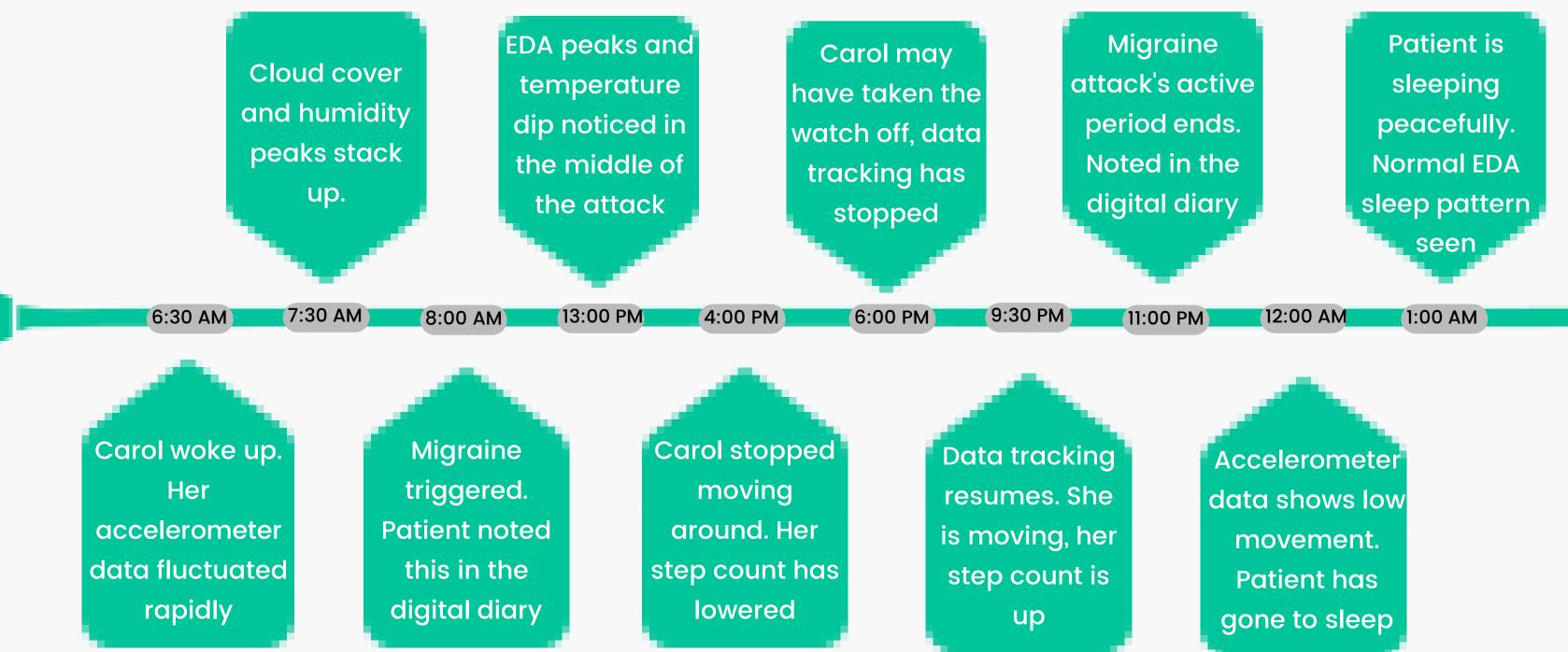


- Continuous tracking of heart rate, EDA, temperature, and movement
- Data covers migraine attacks as well as inter-migraine days, which are just as important as the days of the migraine episode.



CAROL'S STORY

By noting how her biomarkers are changing, we can monitor Carol's migraine attack.



VIII HOW IT WORKS

Each patient acts as their own control. The system gets a certain number of events to train on.

Patients' biomarkers are tracked. Digital Diary records events. Weather data pulled from NOAA

Train the model.

This takes the burden of tracking off the patient, by finding triggers and helpers in real-time. The longer a migraineur uses the tool, the more accurate the tool becomes. Focuses on factors that are important for that particular patient. It dynamically assesses where the patient is on the migraine potential map

Predict migraine episodes when triggers and biomarkers stack up.

> Suggests helpers when the triggers start stacking up to ward off the migraine attack.

IX QUALITY ASSURANCE MODULES AND SCALABILITY

Cross Validation

cross checking data across streams

QUALITY ASSURANCE MODULES AND SCALABILITY

User

Interface

patient-oriented digital diary app,

designed upon UX research

Data Integrity

data tracking modules notify when data quality is impacted

High Fidelity Real-time Models

dynamic migraine risk assessment maps

X RELEVANCE

Care Extender

1 neurologist per 2 million people care extender->enables the patient to upgrade their health

RELEVANCE

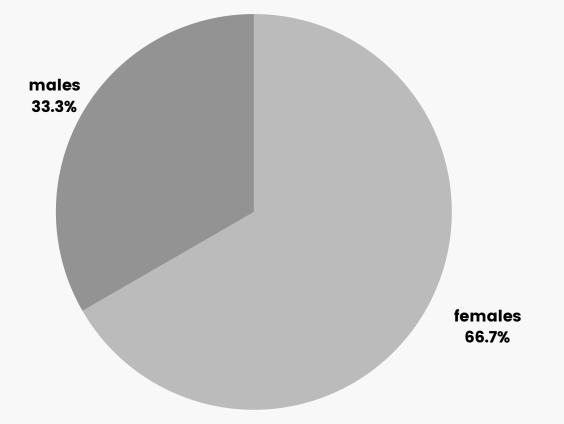
Combat

Self-Medication

Empowers care without resorting to medication.

Women Health

~35 million female migraineurs. Pakistan ranks low(143/156) on the Global Gender Gap Index Report on gender equity in health outcomes, which may be why, despite the suffering migraine causes, it is not a high medical priority.



XI ACCESSIBILITY

High penetration of smartphones

Wearables usage on the rise

Workarounds with less data streams

3 streams of data: wearables, digital diaries, and weather. Even without a wearable data stream, we can use self-reported stress, accelerometer data, ambient noise, and light from smartphone sensors to make sound predictions.

Weather data is readily available

XII VALUE CREATED

Builds a platform for all chronic diseases with episodic exacerbations

Identify archetypes of migraine within the population

Perfect timing!

Before smartphones and current tech, it was hard to collect this data Before big data, it was hard to process and analyze this data This is work that could not have been done 10 years ago.

Less pain and suffering for migraineurs, more productivity for the country

Reducing uncertainty in migraineurs' life, the self-reported cause of great distress.

XIII THE TEAM

• Dr. Basmaa Ali:

Clinical Instructor at Harvard

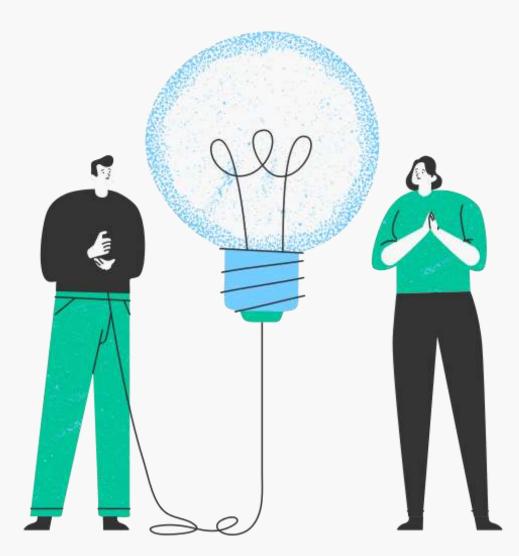
Visiting Fellow at LUMS

• Dr. Agha Ali Raza:

Asst. Prof. CS Dept, Director CSALT LUMS,

Machine Learning expert

- Students (CS, Psych, Bio):
 - Sheza Munir health tech pro (Project Lead)
 - Danyal Maqbool master of data
 - Saad Hasan Iqbal deduction doyen
 - Syeda Mah Noor writing pundit



11th February, 2023

School of Science and Engineering, LUMS Dr. Basmaa Ali (Harvard) Dr. Agha Ali Raza (LUMS)

Thank you!

ADVISORS

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SOURCES

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