PD233: Potential Project Design Briefs:

Groups of 3

Weekly meeting – Monday 2-5pm

Problem 1: (M)

An efficient solution for supporting positioning, alignment and balancing of implants and limb during various knee replacement surgery or Total Knee Arthroplasty

Design Brief:

Incorrect positioning of the implant and improper alignment of the limb following total knee arthroplasty (TKA) can lead to rapid implant wear, loosening, and suboptimal function[1]. A balanced knee contributes to improved alignment and stability. Ligament balancing helps reduce wear and loosening of the joint. A patient with a balanced knee is more likely to have increased range of motion and proprioception, and decreased pain. All these factors help minimize the need for revision surgery[2].

There are existing techniques with which we can achieve correct alignment but they have their own drawbacks and increases the cost.

Can we design a low cost and efficient system which aids in positioning, alignment and balancing of the limb focussing it for the low-resource settings like India?

[1] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3601240/

[2] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3143981/

Problem 2:

An efficient solution for managing Back Problem in Young as well as elderly

Design Brief:

Younger individuals (30 to 60-year olds) are more likely to experience back pain from a lower back muscle strain or from within the disc space itself - such as a lumbar disc herniation or lumbar degenerative disc disease. (https://www.youtube.com/watch?v=zfs9oyA3pKg)

Pain can have a profound effect on a person's day to day life when it goes untreated. People dealing with ongoing or long-term pain can become irritable, short-tempered, and impatient, and with good reason. Constant pain raises the focus threshold for basic functioning, which leaves the pained person with a greatly reduced ability to find solutions or workarounds to even relatively mundane problems.

More than a third of India's adult population is affected by pain. There are existing medication, therapies and exercise which help people with some extent but often are not effective.

Can we design an effective system which can either prevent Chronic Back Pain in High Risk Group patients or treat/manage Chronic Back Pain effectively?

Problem 3: (M)

An efficient solution to help elderly with their issues in Incontinence

Design Brief:

Incontinence is categorized as a disease by the World Health Organization (WHO), as it affects 5% to 7% of the world's population.

Incontinence, can be caused by strokes, dementia, Alzheimer's disease, multiple sclerosis, Parkinson's, or injuries. Conditions such as pelvic floor atrophy in women, prostate enlargement in men, or constipation in either sex can also lead to incontinence.

Currently there are a few treatments- pelvic exercises, medicines, urethral sling surgical procedure, usage of adult diapers. Urinary incontinence impacts 15 to 35% of the adult ambulatory population.

Can we design a low cost and efficient system which helps in managing the incontinence issues and can be adopted with ease by patients?

Problem 4: (M)

A solution which helps patients support in Mobility with a focus on low resource settings.

Design Brief:

We can see mobility being an important aspect for managing the health of a person. A regular program of exercise can strengthen muscles and improve flexibility. With increased strength and balance, an older person is better able to manoeuvre and avoid a potential fall.

Some of the common assist devices that are regularly used are walking sticks, cane, wheel chairs etc

Most of the innovations or solutions currently in use are not affordable to emerging economies like India specifically in the rural settings.

Can there be an affordable solution which could help elders to lead an independent life?

Problem 5:

Diagnostic and support tool for Depression

Design Brief:

Depression is a common but serious mood disorder. It causes severe symptoms that affect how you feel, think, and handle daily activities, such as sleeping, eating, or working.

According to the World Health Organization, India is one of the most depressed countries in the world with a whopping 36% of Indians likely to suffer from major depression at some point in their lives. Depression can happen at any age, but often begins in adulthood.

Depression, especially in midlife or older adults, can co-occur with other serious medical illnesses, such as diabetes, cancer, heart disease, and Parkinson's disease. These conditions are often worse when depression is present.

No two people are affected the same way by depression and there is no "one-size-fits-all" for treatment.

Can we have an affordable solution to diagnose depression early?

Problem 6:

Solutions to help people with Dementia

Design Brief:

Dementia is a general term for a decline in mental ability severe enough to interfere with daily life. Memory loss is an example. Dementia is a progressive life limiting condition with increasing prevalence and complex needs. Alzheimer's is the most common type of dementia.

Dementia is caused by damage to brain cells. This damage interferes with the ability of brain cells to communicate with each other.

https://www.youtube.com/watch?v=6q-H1-XwCZA

Effects of Dementia: Patients tend to forget everyday things, like names, taking medicines, route to their homes, etc. http://ilearn.careerforce.org.nz/mod/book/view.php?id=256&chapterid=181

Symptoms vary from decline in memory or other thinking skills which affect the patient's ability to perform everyday activities to vascular dementia which occurs after a severe stroke.

http://connectingcare.org.uk/articles/detail/dementia-technology-resources

List of videos showing the impact of technology in healthcare for dementia:

https://www.sharecare.com/video/healthmakers/john-lach/empowering-patients-with-technology

Assistive technology for Dementia patients: https://www.youtube.com/watch?v=6Js0jjKYltY

Reliable system for Dementia patients: http://www.neat-group.com/se/en/solutions/dementia-systems/

Can we design a low cost and efficient system for assisting patients suffering from Dementia?

Problem 7:

A universal infusion system which can be used to infuse fluids, electrolytes, nutrients etc in a controlled rate and dosage.

Design Brief:

Infusion of balancing fluids, electrolytes and nutrients is a critical process especially in cased of elderly as well as infants. Similarly, arterial infusions are equally critical in all age groups. The various problem seen are related to controlled flow rate, measuring the infusion dose, back flows, maintaining pressure etc.

Currently, we have infusion pumps which can do some of this task effectively but there are some adverse effects reported in the recent years. Manual methods of delivering infusions has its own challenges right from lack of control to issues such as blood clot and back flow of blood.

Can we design an efficient infusion system which can be adapted across various scenarios and be used/re-used in low resource settings like India?

Problem 8:

An effective solution for Patients with Hearing Impairments.

Design Brief:

Children with hearing impairment need expensive hearing aid and 3-4 years of therapy, making the current solution very expensive.

These days, there are some good hearing aid available in Market these days which costs anywhere Approx. between Rs. 5000 – Rs. 30000 but still when it comes to the children and population below poverty line / Base of Pyramid, they may not be able to afford the hearing aid.

Apart from hearing aid, therapy plays the most important role after the child is given with an Hearing Aid or Hearing Implant. 3-4 Years is the average time required for therapy and only after that the child gets adapted to the sense of hearing. These therapies thus become expensive due to the longevity and a lot of time w.r.t hospital visits and waiting period affects the patient as well as the person accompanying the patient.

If the therapy is not properly administered the child may have problems with respect to balancing, learning disabilities apart from other social stigmas.

Can there be an affordable solution which can impact the lives of many patients suffering from Hearing Impairment.