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INNOVATIONS IN PHARMACY

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Abstract—Pharmaceutical innovation requires novelty of effectiveness. The main factor of innovations in pharmacy should have safety measures. Pharmaceutical innovations create value to society by making it possible to generate improvements in patient health (net of treatment risks) that were previously unattainable. Some of the innovations such as countdown medicine timer, pill intake tracker, glucose maintaining device, migraine preventing headbands, smart asthmatic gadgets, mobile mini kits. In these serious of innovations will bring to the recent trends of pharmaceutical industry.

Keywords—Pharmacy, recent trends, safety, effectiveness, Smart pharmaceutical devices etc.

I. INTRODUCTION

Pharmacy is the science of Preparing and dispensing medical drugs. The study of pharmacy involves chemistry and pharmaceuticals, among other specialist topics. Educating patients & healthcare professionals on the safe use of medication is essential. Developing & conducting research on medication use and patient safety. Explain & utilize principles of health and wellness as appropriate to the provision of specific individuals and populations health & wellness information. Recently developed innovations in pharmacy are helping these stores fight addiction, provide safer remedies, and even offer basic medical services, creating an increasingly flexible paradigm of healthcare that allows these stores to better serve their communities, as well as drive growth.

DEVICES:

The following are the some of the innovations

1. Countdown medicine timer
2. Pill intake tracker
3. Glucose maintaining device Pedometer
4. Menstruation pain relieving belt
5. Smart asthmatic gadgets

6. Pain free diabetic devices
7. Altruistic Eye Surgeries
8. Hi-Tech Emergency Kits

1. Countdown medicine timer



fig.1.1 Countdown medicine timer

1. Capsule-look Pill Box Timer
2. Can hold pills, tablets and capsules.
3. Count down scope: 24 hours.
4. Liquid crystal display with buzzer.
5. Pre-remind you at 10 and 5 min before set time.
6. Battery: 1×AG13 button cell (included).
7. Unit Size: 86×31×31 mm . Packing: Inner Packing: Blister, QTY: 280 PCS, G.W.: 12.5 KGS, N.W.: 11.5 KGS, MEAS: 47.5×32×46.5 CM.[1]

Advantages:

Countdown medicine tracker of digital includes cheaper for a manufacturer to make (no precision gears) and cheap custom COB microcontrollers with built in LCD segment drivers. Bare LCDs are cheap too, ordered in the hundreds of thousands, so LCD design costs can be spread out over many units. For the hobbyist, the digital timer has advantages like the ability to make a custom looking timer no one else has, or with capabilities no manufactured timer has.[1]

2. Pill intake tracker



fig.1.2 Pill intake tracker

The automatic pill dispenser helps you to arrange your medicament into proper parts. It helps you to take your medicament on time by the alarm clock that is provided. Nowadays most of people prefer modern tool to take medications. Has all the seven days of the week and has multiple storage boxes for each day Material: PP + ABS/ Power By: 2 x AAA 1.5V Battery, Size: 18.5 x 10.5 x 2.3cm or 7.28 x 4.13 x 0.91in (L x W x H), Weight: 122g, Package Contents:1 x Automatic medicament Dispenser Alarm Clock,1 x User Manual. [2, 24]

Advantages:

Ease of use. Despite serving a serious purpose, a medication tracker looks pretty simple and is usually user-friendly for all age categories. The icons are self-explanatory; the interface is minimal and not overloaded with extras. The medication tracker apps tend to be relatively lightweight. They do not eat up much memory on the phones and do not require super-quick Internet. [2]

3. Glucose maintaining device Pedometer



fig.1.3 Glucose maintaining device Pedometer

The pedometer is used to monitor the physical activity of the diabetic patient. Physical activity is defined as any movement that increases the use of energy, such as walking or playing a football game. Physical performance must be advice to all diabetic patients as part of the management of their level of glucose and for improving their health. For our practical

application, we tried to work with the smart watch, which already contains a pedometer. We ask the diabetic patient to put the smart watch in their hands, and we automatically receive the number of steps and the distance crossed by the patient on the application installed on the smart phone of the patient. He benefits of exercise are well known. Decreased risk of and management of chronic diseases like diabetes and heart disease, improvements in bone density, decreases in blood pressure, reduction in certain types of cancer, increases in muscle strength and endurance, alleviation of symptoms of depression, and elevation of mood are just some. The quantity of exercise necessary to accrue these benefits is also well known. There are two national recommendations to choose from. First, the Surgeon General recommends 30 min or more of moderate-intensity physical activity on five or more days per week to improve health and fitness. You can accumulate it in 10- to 15-minute bouts throughout the day or do it all at once. "Moderate intensity" physical activity makes you feel warm and slightly get out of your breath when you do it. And second, the College of Sports Medicine of American advices a more formal, workout prescription of 20-60 minutes of continuous activity, three to five times a week (at 60-90% of maximum heart rate reserve) and two to three days of resistance training. Mostly useful in type2 diabetics mellitus[3,27]

Advantages:

The merits of a pedometer are, it records small activities while some performance of our body, like walking stairs instead of taking elevators. Many people who increase activity while wearing pedometers seem to do so through these small bits of walking that would probably escape anyone's attention. [4]

4. Menstruation pain relieving belt



fig.1.4Menstruation pain relieving belt

Use: The belt consists of high-quality soft Lycra fabric, which allows you to breath, be comfortable and makes warm when it is nearer to your skin. Comfortable Velcro and elastic waistband for up to 40 inches for waist circumference: 23" - 40". It can be used for multiple body parts.

Heating performance: It warms up in 3 sec. and you do not need to wait; Up to 95% heating area makes the temperature uniform and comfortable; 3 Heat Settings to adjust the level of heat; Press switch 3 seconds ON/OFF; Press switch quickly for modes change: 113°F (Blue), 131°F (White), 149°F (Red).

Advanced heating therapy: It is grandest heating belt with flattest Graphene Heating Chip that release FIR thermal energy, which delivers heat to the body to have good Blood Circulation and Relax the Muscles, greatly relieve pains from Cramps, Back, Sore Muscles, etc. **Portable and Washable:** Ultra-thin to 0.1 inches, breathable and lightweight. It works neatly under your clothes without exposing a bump or beam. **Foldable,** no space occupied you can carry it wherever you go. **Can be washed** (recommended hand wash, please use after drying).

Waterproof & washable: The heating waist belt is Washable in water, and it won't have risk of electric shocks. Hand wash and air dry are recommended to extend service life for heating pad. Turn off it before you start the product and don't switch it on until it is drying enough. The waist heating belt can be regarded as a perfect choice for valentine's day gift, Christmas gift, birthday gift for mum, dad, girlfriends, boyfriends, daughter, son, friends. The heating Belt helps to concure pain with warm massage that you control. Choose from 3 vibration levels and set the temperature to warm the area.

Advantages:

It helps in monthly period pain relief. Postpartum pain relief, and Other abdominal pain relief (intestinal pain, lower back pain). The Menstrual Pain Relief Massage Belt comes with the Menstrual Pain Relief Massage Belt, A USB cable for charging, A User Manual.[5]

5. Smart asthmatic gadgets

Asthma is a chronic illness which can flare up at any time. And in America alone, more than 24 million people suffer from asthma, making it an extremely common malady. Thankfully, with modern science and technology we are now far better equipped to deal with asthma, using cutting edge technology to keep the wheezing at bay and your air passages open. The asthma dealing box has the technology connected with gadget that involve electrical and medical care to both track asthma and aid in its prevention and alleviation. There are five good gadgets that will help to fight chronic illness. Whether you're a new sufferer or have been battling with asthma since childhood, these gadgets can help avoiding that overwhelming feeling of stress and panic that can trigger attacks, help in smart inhalation.

Advantages:

They're all designed to automatically track how often you're using your inhaler, so you don't need to keep your own records. Some trials have suggested that if you use a smart inhaler it can make it simple to stick to taking your medicine. That means you get fewer symptoms. [6, 25]

A) Gecko Cap



fig.1.5 (A) GeckoCap

Inhalers such as Ventolin help to control asthma symptoms. Many people are known to the asthma inhalers, as asthma is the inflammation in the breathing areas particularly who have asthma, but the main challenge with asthma sufferers is that they forget to take their medicine unless they are experiencing an attack and need immediate relief. Inhaler trackers seek to solve that problem with a few innovations. The Gecko Cap is a small rubber item that goes on top of the canister which contains the salbutamol. It has LED lights which light up when it's time to take the recommended dose, which reminds people, kids in particular, to take their medicine. It won't stop blinking until the dose is taken so it's hard to ignore. When the inhaler is pressed, the device transmits this data through Bluetooth to a computer or smart phone, which tracks the usage of the inhaler. This is helpful for parents or doctors who need to monitor whether the patient is taking their medicine. [7]

B) My Spiroo



fig.1.5 (B) My Spiroo

The My Spiroo is a peak flow meter, a device used to measure maximum rate of air flow out of your lungs during exhalation. Asthma attacks tend to have a downward trend in flow, so these devices can really give a clear picture of how bad your asthma is, or how much you have recovered. This portable spirometer also connects to your smart phone through a headphone jack and records your flow data automatically, saving the tedium of needing to write it down, and has a geolocation function to help release warnings for pollen-heavy areas and possible pollutants that can trigger attacks.

Advantages:

Spirometry (spy-ROM-uh-tree) a test that tells u the amount of air that u inhale and your lungs are in good condition, how much you exhale and how quickly you exhale. Spirometry is used to diagnose asthma, COPD and other conditions that affect breathing. Spirometry may be used occasionally to monitor your lung condition and check that a treatment for lung condition is allowing you to breathe better. [8]

C) AirSonea



fig.1.5 (C)AirSonea

The AirSonea takes a different approach to monitor your asthma levels. Instead of the peak flow meter approach of directly measuring your breath, the AirSonea is a wheeze detector that records airway sounds and presents the recorded sounds as visual data for a parent or doctor to interpret. Data is captured by putting the device to your windpipe for half a minute. The resulting measurement is known as the Wheeze RATE, and is sent to a Bluetooth-paired phone where the device's algorithms can determine if wheezing is occurring based on the patterns in the sound graph. It's easier to use than traditional peak flow meters, and is a first of its kind, so it's an exciting asthma gadget to watch. [9]

D) Cefaly:



fig.1.5 (D)Cefaly:

An electrode is firmly placed to the forehead by the sci-fi Cefaly headband to assist lessen the frequency of migraines. The most recent migraine prevention method involves wearing a headband that more closely resembles something from Star Trek than a doctor's office. But don't let the slick design fool you. The Cefaly headband uses simple pain-relieving technology that has been around for years. The headband's battery power presses an electrode against a person's forehead, where it sends an electrical signal through the skin to the

trigeminal nerve. The futuristic Cefaly headband firmly presses an electrode on the forehead to assist in lowering frequency of migraines. By stimulating the nerve, which plays a role in many migraines, the device was shown to help prevent the headaches in a clinical test involving 67 people. Some got the Cefaly device and others used a sham headband. The people who wore the Cefaly device 20 minutes a day took fewer migraine medicines than those who got the dummy device. This week the FDA cleared the device for marketing in the U.S. The headband, made by STX-Med, costs \$295. The three electrodes in a package (good for about 60 treatments) runs \$25. The company is selling the battery-powered headband online, but you have to email a copy of the prescription from the doctor to the business. a polling of almost 2,300 persons who tried the device for two months, on average, found that slightly more than half were to be a knock-it-out-of-the-ballpark thing. People may find it somewhat helpful." But there are few risks to TENS either, he says, adding, "I don't think I've ever seen anybody injured by it. [10]

Advantages:

These are the most commonly used approaches for migraine. Supraorbital stimulation targets the branch of the trigeminal nerve that brings sensation to the forehead, upper eyelid, and scalp. Vagus nerve stimulation (VNS) targets a nerve called the vagus extends from the brainstem to the abdomen and communicates with a variety of muscles and organs along its entire length, including the small intestine and colon. Occipital nerve stimulation (ONS) targets nerves on the back of the scalp. Remote electrical neuromodulation (REN) stimulates peripheral nerves in the arm, with the goal of blocking pain signals from reaching the brain. Single-pulse transcranial magnetic stimulation (sTMS) is not aimed at any particular nerve but rather at the brain more generally. [11]

6. Pain free diabetic devices



fig.1.6 Pain free diabetic devices

These help in standard caring of the diabetic patients [26]

Advantages:

A glucometer can help you achieve your blood sugar goals with better adherence to your medication. Tracking your levels of blood sugar allows you to understand the importance of

how diet and exercise affect your glucose levels. It also helps your doctor adjust your individualized treatment plan.

A) D-Base



fig.1.6 (A)D-Base

D-Base is a shoebox-sized blood sugar monitor developed by the German firm DiaMonTech. The device measures blood sugar levels by beaming an infrared laser through the skin of a finger and causing glucose in the skin to convert the light to heat. The machine then calculates glucose levels based on the increase of heat in the skin. The increase in temperature is too minimal to be noticed by the user. In 2019, D-Base was approved in the EU for use by medical professionals in clinical trials and diabetes centers. To help introduce D-Base to the American market, the company raised a total of \$20 million earlier this year after securing \$5 million in finance. DiaMonTech is also developing scaled-down versions of the technology including a handheld device called D-Pocket as well as the small D-Sensor that can be used in wearable devices. [12]

b) Eversense



fig.1.6 (B)Eversense

It is developed by U.S., although it initially needs to be installed under the skin by a doctor, the sensor can last for up to three months before needing a replacement. Ever sense measures glucose in the interstitial fluid under the skin of the upper arm by using a polymer that fluoresces in response to the levels of blood sugar. The data is then sent to a transmitter that displays the blood glucose levels in real time. The device

received U.S. Food and Drug Administration (FDA) approval in 2018 and Ever sense is a subcutaneous implant that continuously monitors blood sugar and is made by the Senseonics firm and supplied by Ascensia Diabetes Care.[13]

c) GlucoTrack



fig.1.6 (C)GlucoTrack

Developed by the U.S.–Israeli company Integrity Applications — now rebranded as GlucoTrack, Inc. — the GlucoTrack device can monitor blood sugar levels through a thermal, electromagnetic, and ultrasonic waves combined. To provide readout, the sensor is clipped on the ear. The device is indicated for adults with type 2 diabetes and is marketed in Europe. Integrity Applications now aims to expand into the U.S. and is developing the second generation of GlucoTrack, which consists of a wireless ear clip sensor paired with a smart phone. Initial study results of the Gen 2 monitor have shown good performance and accuracy. [14]

d) GlucoWISE



fig.1.6 (D)GlucoWISE

Gluco WISE is a sensor under development that could measure blood glucose levels by just placing it on the skin between the forefinger and thumb. The real-time measurements are then sent directly to a smart phone app. By using a specific frequency of radio waves to measure blood glucose levels, the developers believe the device would be more accurate than are other wireless glucose monitors. The U.K. firm behind the technology, MediWise, was acquired by the Canadian photonics and intelligent materials specialist Meta Materials in 2018. Meta Materials is continuing the development of glucoWISE, which has already been tested in two small-scale human trials. Early in the year, the device was

granted a Non-invasive glucose sensing is covered by a U.S. patent system. [15]

e) NovioSense



fig.1.6(E) NovioSense

Dutch company Novio Sense startup working on a device that is used to monitor blood sugar under the lower eyelid, from where it can wirelessly send glucose measurements directly to a smartphone. The device consists of a flexible metal coil of just two centimeters in length with nanosensors contained inside. In turn, the coil is covered by a protective layer of soft hydrogel. The coil uses the same enzyme technology as standard glucose strip tests to measure minute variations in the glucose levels of tear fluid.. According to results from a clinical study published in 2020, the device is comparable in accuracy to the Freestyle Libre. [16]

f) Occuity Indigo



fig.1.6 (F)Occuity Indigo

As an eye-focused blood glucose meter, Occuity Indigo takes a literal approach to the expression “the eyes are windows to the soul.” The U.K. does not measure tear fluid. Developer Similar to the Google Contact Lens, Occuity sees into the eyeball since it is a transparent, stable environment whose glucose levels match those of the blood. The Occuity Indigo emits a slender light beam into the eyeball and measures the light that bounces back into the device. It can infer glucose levels in the eye based on the refraction of the returning light. The technology, which is still in research and development, was crowd funded on Seedrs. Occuity is also developing a similar device that can screen people at risk of developing diabetes and other health conditions in the future. [17]

g) SugarBEAT



fig.1.6 (G) SugarBEAT

Sugar BEAT, developed by U.K. A changeable skin patch with a transmitter connected by biotech company Nemauro Medical is suited for persons with both type 1 and type 2 diabetes as well as pre-diabetes. It gauges blood sugar levels non-invasively by passing a low-level electric current across the skin that draws out a sample of the interstitial fluid, found just below the skin. The The rechargeable transmitter uses Bluetooth to communicate data to the user's phone every five minutes, and an associated app may be used to view the findings. app. Nemauro's smart device already has marketing approval in the EU, and the company has submitted a Premarket Approval to the U.S. FDA, which is currently in review.[17]

7. Altruistic Eye Surgeries



fig. 7Altruistic Eye Surgeries

Aurolab is Eliminating Needless Blindness via Affordable Cataract Surgery, Bianca — Mar 2, 2012 — Social Good Aurolab is an eye care social enterprise in southern India that provides 1.5 million intraocular lenses annually, or the majority of the world's supply. Intraocular Lenses are used in cataract surgery -- the most popular form of vision restoration surgery for people whose natural crystalline lenses have become obscured. A component of the Aravind eye care system is aurolab, which offers high quality products at an affordable price, making clear vision more accessible."Aurolab's products are exported to 130 and more

countries worldwide, with focus markets like India, Africa, Latin America, Central America and Southeast Asia," the website explains. "Aurolab envisages entering European and other developed markets on the strength of its product quality and as a strategic means to cross subsidized products in needy markets.[18]"The Aravind Eye care system was founded by Dr. G. Venkataswamy who saw an opportunity to bring Intraocular Lenses to the majority world in the early 90s, a time when the concept was criticized for being too expensive to offer in those regions. He created AuroLab as a non-profit division of Aravind to assist in the cheaper delivery of intraocular lenses. [19]In 1997, they expanded to include ophthalmic pharmaceuticals like eye drops. Since then they have added products like surgical blades and Green laser for diabetics. Over the years, Aurolab has held strong to its mission to eliminate "needless blindness by making high quality ophthalmic products affordable and accessible to vision impaired worldwide." They value innovation, identifying emerging opportunities and they empower their employees to strive for constant growth and development. A case study is been peovided over IT [20,28]

Advantages:

The Restoring the eye's normal optics is a great opportunity provided by refractive cataract surgery. It improves the clarity of vision once a cataract forms inside the eye. The big benefit of lifestyle cataract surgery is that once it's performed, the vision tends to remain very stable, so when you get a good result from cataract surgery, and you get your distance vision back, and you get the near vision back, you tend to keep that. It usually stays decently stable for the long term. [21]

8. Hi-Tech Emergency Kits



fig.8. Hi-Tech Emergency Kits

First Aid 2.0 Guides the Lifesaver through a Rescue with its Digital Screen

Amelia Roblin — Jun 14, 2012 — Lifestyle

No matter how many times people learn their basic lifesaving skills, in those moments of panic, many are likely to forget it all. The First Aid 2.0 assumes that the first person at the site of a collision will know nothing about how to identify or treat a particular injury so it offers a wealth of advice and instruction on the very lid of the box.

The sleek cover of Ying Hern Pow's first aid box features a touch screen that is molded into the surface in the form of a red cross. Touching the display will activate the computer inside and present the user with a selection of common afflictions that he may chose to select or investigate. Search capabilities produce directions for how to assist victims of a wide variety of trauma, and under the hinged lid of the First Aid 2.0 are the familiar medical tools to carry out minor procedures before the ambulance arrives.[22]

Advantages:

First-aid you can respond to medical situations more swiftly with the aid of kits. Even a minute's delay in an emergency can result in irreparable harm. These kits offer basic and instant care for common medical injuries like injuries, burns, cuts etc.[23]

II. CONCLUSION

Thus we can conclude with, that the various innovation in pharmacy are suitable for its specific use and most reliable to the future, even they are useful in various ways to make patient feel better. The innovation such the counter pill tracker, smart asthmatic gadgets, pain relieving belt (electronic), hitech mobile kits or emergency kits, diabetic device are really useful in day to day life and their demand will be great as soon as possible in future.

III. FUTURE SCOPE

Researchers are developing smart mirrors that use advanced cameras and your breath to detect health variations. Multiple companies are testing and working on home health care bots that can perform basic services, while elderly workers in Japan are using exoskeletons to extend their ability to perform manual labor. Smartphones are evolving to allow them to act as point-of-care and home health diagnostic tools for conditions such as urinary tract infections or diabetic eye disease. Labs have produced an ingestible origami robot that can be swallowed and controlled to patch a wound Companies are using the gut micro biome to create a food-as-medicine approach to manage glucose levels and improve overall health.

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