Original Research Article

Use of m-health Application to figure out Post-natal Depression, An Evidence-Based Study

Abstract:

Background: Post-natal depression is a clinical condition that may go undiscovered. The evolution of a clinical issue needs medical attention, where study-proven results suggested great compassion, efficient and satisfactory precision in outcomes especially prompt accomplish, simple to elucidate, in cultural terms appropriate, and economical. The objective of this study, to generate organizational paradigms for identifying the risk of post-natal depression after a week of child delivery, accordingly permit quick interruption, and also, to create a digital health application for the latest platform such as (Google Health Studies, Mountain View, Medication Management, Point-of-Care Diagnostics) along with the elite implementation for both pregnant mothers and physician that desire to observe their patient's test.

Methodology: The study was a prospective cohort study. A set of prognostic paragons used for computing the chance of post-natal depression was utilized device acquisition capabilities and record evidence practically PPD mothers gathered from different hospitals. The analysis was implemented through a hold-out technique. A simple scheme diagram and framework for organizing the figure. Idol picture portrait (IPO) of the mobile health application was tracked.

Results: The results showed that the study of Naive Bayes demonstrated the significant equilibrium among specificity and sensitivity through the prognostic paradigm for post-natal depression, after a few days of delivery. It was unified toward the clinical verdict assist method for the Android m-application. Unique strategy can permit the premature prognostic and identification of post-natal depression so long as it satisfies the requirements of a potent screening trial with a great degree of specificity and sensitivity which is rapid to execute, simple to interact with, ethically perceptive, sympathetic, and economical.

Keywords: Post-natal depression, Machine Learning, Pattern recognition, m health, Android application.

INTRODUCTION

PPD is a Phase which describe the duration of biological evolution between the newborn and the mother. Approaches of distress, aggravation, pain are usual in the few days after delivery and generally diminish aside from any therapy [1]. Modern developments have an important place in life. The term mHealth (mobile health) refers to the use of mobile devices, such as cellphones and tablets, for healthcare delivery. Mobile devices to transmit various health information [2]. whereas mobile health apps provide the distribution of secure data, they help improve the health attitude of the person. It is noted that approximately 75% of the world's population has reached at least one mobile health application. By alleviating transportation, individual requirements can be met without time constraints. In a very delicate period, such as the postpartum period, when the need for information and social support increases, the possibility of psychological illness in women rises. Postpartum depression is a condition that needs to be treated and influences the attribute of vitality [3]. Most women with PPD do not take therapy, which can interfere with the treatment process. Many factors such as limited time, economic futility, trouble in transportation, neonatal care, and disgrace. Offering personalized care, instant diagnosis, and intervention by healthcare consultants have major significance. Here, the applications brought by technology should come into play and make the operate both women and healthcare providers better [4]. As a consequence of many mobile applications developed, it has been demonstrated that women are efficient in preventing and lowering postpartum depression. Simultaneously, it is observed that women improve their standard of living, perform daily routine conveniently, attachment occurs more easily, and lactation rates are increased. In the background of all these positive results, mobile health applications can be recommended for daily use. In the future, it will be very important to develop mobile applications to meet the needs of women in all other areas, including postpartum depression [5].

Methodology

The data came from the Pakistani health care sector wherein data about recently given birth was obtained from five different health care units. Period of time was 11th month, all the candidates were Asian, none had been follow mentally illness therapy at the time gestation, and all have been capable of reading and respond the assessment survey. 65 were eliminated for the reason that failed to do so appropriately complete all the survey questions [6]. Along with cases, a longitudinal Prospective Cohort Study was done postpartum period and during 8th weeks and 32nd weeks after childbirth. At the 8th week outcome, 1,380 (72%) females continued in the research. At the 32nd week response 1,258 (74.2%) female was surveyed [7]. Altogether, 12.2% (n = 140) of the females at primary, 8th weeks, and 32nd weeks possess a significant depressive episode throughout the 8th months of after childbirth follow-up. Consequently, out of 1,258 patients, 140 coincide to the positive category and 1,258 to the negative category [8].

Predictor variables

Predominantly, just 9 out of 14 variables primarily practicable has been utilized. Along with limitations it is supposed such category presentation highest possible that one achieved in Tortajada et al. Although, it is supposed to be acceptable authenticity, in addition to it is economical and easier to respond. Hence the information from the previous data, 9 variables fulfil such circumstances [9].

Social and economic variables were age, educational qualifications obtained, graded on a 3-point scale of high, medium, or low, working conditions during pregnancy, incomes of family's rate on a scale of 4 of economics level, sex of the new born, and quantity of siblings living with the female parent. Individual and family history of mental disorder and emotional changes of pregnant mothers had also been observed as second variables (yes/no). Likewise, distressing event in life are studied as factors of risk in the publications and health guides. The quantity of these events as after childbirth following to the patient's perspective was utilized [10].

The personality trait, Neuroticism is the characteristic tendency to undergo adverse effects, comprising, anxiety, anger, self-actualization, psychosis, and depression. Neuroticism and depressive signs were estimated by the score on the analogous other two psychological tests. The (EPQ) Eysenck Personality Questionnaire short scale, frequently applied personality questionnaire, evaluate neuroticism. it comprises of 10 elements. Persons have maximum with neuroticism more hypothetically higher above the usual to incident of emotion like guilt, anxiety, anger, and depression. Practice which specify whether mothers experienced postpartum depression (PPD) in the course of the prospective cohort study. EPDS, Edinburgh Postnatal Depression Scale; DIGS, Diagnostic Interview for Genetic Studies [11].

Pattern recognition and Machine Learning

Pattern recognition indicate to the spontaneous detection of characteristics in a given statistic on categorize them between different categories. PR models generally perfected utilizing ML techniques. The life cycle of ML problem-oriented pattern recognition can be divided into two main periods: recognition and training. During the training phase, a set of data is used to create the PR model. This is getting out the phase at which adaptive model is adjust in order to best practical generation, and therefore new pattern are resolved throughout the recognition phase.

Sensitivity, specificity p, indicated on the intermission (0, 1) and leads to high values only if both values are elevated and equivalent. During the current work, the best performing classification model is the one that has the highest G value on the test data set [12].

GUI ARCHITECTURE

The primary challenge of an application's graphical user interface (GUI) is to set up a simple visual environment to enable communication between the software and the customer. A smartphone application generally consists of a set of activities that the user can browse. All activities leading to an application must have a common goal. As far as our study is concern the

main aim is to facilitate the ultimate user acquire an evaluation of the chance of developing PPD. By answering the survey form they perceive in an obvious manner and straightforward approach the outcome of the classifier, in other words, whether the mother belongs to the PPD risk group or not [13].

Table 1. Predictor variables used in this research

EXOGENOUS VARIABLES	NUMBER MISSING	NO PPD	PPD
Age (years)	0	31.16 – 4.12	31.78 – 4.87
Educational level	2		
Low		334 (27.2%)	56(34.8%)
Medium		488 (42.0%)	68(41.8%)
High		393 (31.9%)	37(23.7%)
Labor conditions during pregnancy	5		
Employed		876 (71.2%)	85 (55.1%)
Unemployed		145 (11.0%)	22 (12.8%)
Student/ homemaker		134 (8.6%)	17(12.3%)
Leave		156 (9.4%)	34 (20.8%)
financial level	18		
Adequate income		840 (68.0%)	82 (52.2%)
Enough income		312 (25.4%)	52 (38.1%)
Tight income		74 (6.0%)	20(17.9%)
Economic Issues		7 (0.6%)	7 (3.8%)
Gender of the newborn	18		
Male		597 (48.0%)	68 (43.9%)
Female		624 (51.0%)	87 (57.1%)
No. of members living together	32	2.64 – 0.97	2.67 – 0.76
Psychiatric predecessors	75		
No		780 (66.9%)	87 (57.1%)
Yes		367 (31.1%)	75 (47.9%)
Emotional changes during pregnancy	0		
No		75 (5.8%)	18(11.6%)
Yes		1,174 (96.1%)	145 (87.4%)
Life events after delivery		20.88 – 1.067	1.50 – 1.08
Neuroticism (EPQN)		64.25 – 2.63	5.87 – 3.75
Depressive symptoms (initial EPDS)		5.74 – 3.97	8.76 – 4.75

For categorical variables, the number of patients is given as a percentage. The mean standard deviation is given for non-categorical variables. The number of missing values for each variable is shown in the second column.

The statistics for each class are shown in the last two columns [14].

Table 2. Classification Results Comparison to achieve the Best Models During the present study and During the Study of Tortajada et al. on the Test Dataset

MODEL NAMES	VARIABLES NUMBERS	WEEKS NUMBERS	G	SEN	SPE	AUC	Confidence interval (95% CI)
Tortajada et al.	09	8-32	0/83	0.79	0.89	0.87	0.87(0.07, 0.77)
Naïve Bayes	09	1	0.75	0.78	0.74	0.78	0.75(0.69, 0.78)
Logistic regression	09	1	0.68	0.65	0.76	0.78	0.75(0.68, 0.78)
SVM	09	1	0.67	0.57	0.76	0.77	0.77(0.67, 0.77)
ANN	09	1	0.68	0.58	0.87	0.68	0.78(0.76, 0.85)

The chart above shows the details of the number of independent variables used, a minimum number of weeks after the G-score, the sensitivity (SEN), the specificity (SPE), the area under the curve (AUC) and the model accuracy with its confidence interval (CI) at 5% significance for the test data set. ANN, artificial neural network; SVM, support vector machines [15].

RESULTS

The research shows the user the analyzed result in an obvious and clear pattern form, avoiding user interference with understandable terminology. The highest G-vessel Bayesian model relates to normal placement as long as there is an independent probability distribution and uniform prior probabilities. The leading logistic regression model showed a cut-off value of 0.12 in the output values delimiting the classes. The best ANN model achieved had a 12-6-4-1 topology. The Nave-Bayesian model showed the best execution of the test data set based on the G-function with a value of 0.78. With values close to 0.78, a perfect balance between sensitivity, specificity and accuracy was achieved in all cases. Therefore, a new Nave-Bayesian model was retrained with the above best hyperparameters and using all available data of 9 independent variables and integrated into the mobile smartphone application.

Discussion

Presently, advancements in technology establish a great influence on life. In addition, current developments also contribute to health traditions. Current developments in technology have made it easier to access information about health and disease. Mobile Health (mHealth), a subset of Electronic Health (eHealth), is defined as the use of mobile devices to provide various health information. Telemedicine, mobile applications and text messaging (SMS) are examples of mHealth [17]. The World Health Organization (WHO) defines mobile health as medical and public health practices supported by mobile devices such as cell phones, patient monitors, personal digital assistants and other wireless devices. Mobile phones are a significant communication device throughout the globe. The smartphone utilization rate for the female population aged 18-48 in developed and developing countries is over 90%. Since the continued evolution and general use of smartphones, the use of mobile health in the healthcare sector has

also increased. As a consequence, it has initiated to be seen as a source of information among people. Women use electronic information sources such as blogs, social media, forums, and mobile applications during the perinatal period. It is found that the rate of acquisition of information online is between 50-90% in pregnant women. It is found that mothers resort to procurement information online for guidance on newborn health and motherhood. Although mobile health applications provide safe information, they help improve people's health behaviors [18]. Web-based mobile health applications hold a great position in health services. The ratio of applications is rising time after time due to reasons such as ease of access, economic expense, convenience, scarcity of geographical restrictions, and due to time efficiency. Smartphone health applications are among the most downloaded apps worldwide. Corresponding to 2010 data, at least 200 million mobile health applications were downloaded. 70% of the world's population has reached at least one mobile health application. Estimates for the following years are that 1-7 billion people will reach mobile health applications. A study on the outcome of mobile applications reports that it benefits parents to access necessary information, improve their self-confidence and self-efficacy, and help them appoint parenting roles more comfortably. It has been noted that smartphone health applications and virtual health systems participate positively in health outcomes. Simultaneously, it is established that mothers who have information on the websites have a great perception of personal efficacy and social assistance, and reduced stress. In a nutshell, the absolute outcome is recognized to facilitate psychological support to the parents and is thought to minimize the risk of depression [19].

The incidence of depression in women is twice as higher than in men. Approximately 350 million people in the world are affected by depression. It is observed that this aggravation is related with the time period of extreme hormonal variations such as pregnancy, menstrual cycle, postpartum, and perimenopause in women. The perinatal period is a sensitive period where depression and anxiety are common. The postpartum period in particular is a time when the likelihood of mental disorders in women is extreme. Postpartum depression (PPD) occurs separately in 10-15% of women. PPD can appear from the first four weeks after birth to a year. Risk factors for PPD include: anxiety, poor wellbeing, stress, having a child with a chronic illness, and complicated marriages. If left untreated, postpartum depression negatively impacts maternal and neonatal mortality/morbidity rates. In proceedings where postpartum depression cannot be identified, multiple trouble such as maternal suicide, infant death, chronic depression, enhanced substance utilization, devotion, and lactation issues may occur. When PPD is diagnosed early, it is adequate to avoid unpleasant events and avoid complications. Although, the ratio of women receiving PPD therapy is relatively low, at 14-26%. There are various conditions that impact the treatment process of women. These; limitation of time, economic burden, trouble in transportation, child care, and stigma. The leading aim of mobile health applications is to deal with the inhibitory context of these groups [20]. All these barriers are removed with mobile health applications. It is recommended to assist this constituent, where mobile phone use is common, with mobile health applications as a way to decrease restrictions. It is reported that approximately 350 million populations in the world are affected by depression. The incidence of depression in women is twice greater than in men. It is reported that this excess is associated with periods of intense hormonal fluctuations such as menstrual cycle, pregnancy, postpartum, and perimenopause in women. The perinatal period is a sensitive

period where depression and anxiety are common. The time after childbirth is a time when the probability of mental disorders in women is high. Postpartum depression (PPD) manifests itself in 10-15% of women. PPD can occur in the first 4 weeks after birth up to 12 months. Risk factors for PPD include: lack of social support, anxiety, stress, having a child with a chronic illness, and problematic marriages (Hanach, de Vries, Radwan, Bissani, 2021; Jannati, Mazhari, Ahmadian, Mirzaee, 2020; Prabhakar, Bharadwaj , Shivaprakash et al., 2018). Left untreated, PPD negatively impacts maternal and neonatal mortality/morbidity rates. In cases where postpartum depression cannot be diagnosed, many problems such as maternal suicide, infant death, chronic depression, increased substance use, attachment, and lactating issues may occur. The main aim of smartphone health applications is to combat the inhibitory factors of these groups. All these obstacles are removed with mobile health applications. It is recommended to assist this component, where smartphone use is common, with mobile health applications as a way to reduce impediments [21].

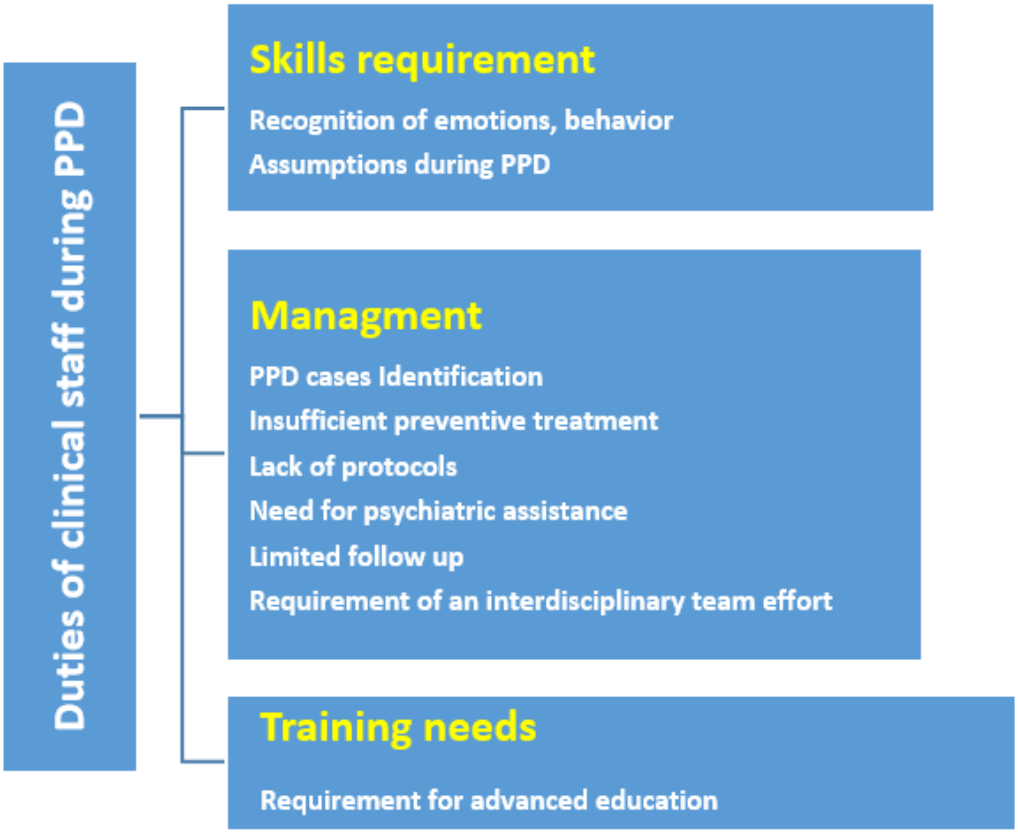

FIGURE 1: EMERGING CLASSIFICATION AND SUB CLASSIFICATION

During and after postpartum females require information on many issues. approaching such information in the comfort of their home and simultaneously with the assurance of a health professional is a very important step for women. When mobile health applications are prepared according to postpartum needs, they have the ability to notify mothers regarding the postpartum period and the advancement of women in this period with the essential information and realistic outcome for their personal health and the health of the newborn. It is an efficient

way to reduce anxiety and depression in the postpartum period; Mobile applications with easy access to individual care are recommended. In its Mental Health Action Plan 2013-2020, the WHO promotes the promotion of self-sufficiency through electronic and mobile health applications. Mobile mental health applications ensure a timely assessment of an individual's condition and generate instant results. Therefore, targeted care during the period of timely diagnosis and intervention is of great importance. Randomized controlled trials showed that use of a postpartum mobile support application limited the rate of depression symptom progression [22]. Smartphone applications are helpful in reducing PPD and resource in reaching reliable information. The practice is efficient in lactating capability and success; It was found that mothers fed their babies exclusively with breast milk at a higher rate and felt more competent. As a result of the meta-analysis research involving 2350 people in total; It has been recorded that telemedicine interventions markedly diminish the symptoms of postpartum depression as compared with standard care, and the use and reliability of the technique among mothers are significant. A randomized controlled trial included 75 women. While before the intervention there was no significant difference between the two groups, the depression score of the women using the application was lower after the intervention. In the study in which prenatal outcomes and post-intervention outcomes were compared; Mobile health apps aimed at reducing PPD have been shown to be correspondent with a diminish in postpartum depression. Because of this, it was found that the postpartum care mobile application developed in another study can improve maternal and neonatal postpartum care knowledge and reduce postpartum depression. It has been reported that a mobile application designed to enhance the roles of mothers and to promote mother-newborn association by increasing social support, thus increasing their psychological well-being and satisfaction, received positive feedback from women. It has been suggested that a mobile application that incorporates fathers encourages mother's adaptation to their parenting role, increases social support, and has the potential to prevent postpartum depression [23]. As a result of systematic research, it has been revealed that mobile applications substantially enhance postpartum depression. It would be sufficient to process the content of mobile applications developed to meet the needs of women in the postpartum period and to support them through healthcare professionals. It is considered that the midwives, who are especially with the woman in her life cycle, should be the priority groups in preparing the content. Nurses and health professionals who are with women and provide education and counseling in many special periods such as adolescence, marriage, pregnancy preparation, pregnancy process, birth, postpartum, newborn care, and menopause. It has been revealed that the mobile application. In another study, it has been reported that preparing the content together with midwives will give significant outcomes [24].

This research demonstrated that smartphone application users experienced significant reductions in PPD, and psychological issues, and anxiety that can negatively affect the life, quality of life, and mental health status of women and their families. It has great significance for healthcare professionals to provide customized service, early diagnosis, and intervention. Here, the applications brought by technology should come into play and make the work of both women and health professionals easier. As a result of many mobile applications developed, it has been revealed that women are effective in preventing and reducing postpartum depression. It is recommended that all healthcare professionals follow current developments and include them in care standards. It would be sufficient to process the content of mobile applications

developed to meet the needs of women in the postpartum period and to support them through healthcare professionals [25].

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