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ORIGINAL ARTICLE

Exclusive Breastfeeding as a Complex Adaptive System: A Qualitative Study

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ABSTRACT

Background: Breastfeeding is a public health issue which has a major effect on the infant growth and development, in addition to the mothers themselves. Benefits of breastfeeding are well-researched from both physiological and sociocultural perspectives. What is missed is the tactile nature of breastfeeding that function as a semiotic medium, that is, a communicative medium for values and meanings of motherhood, love, happiness, security and wholeness.

Objectives: The objective of this study is to explore the essential meanings that become a mental model embodied by adherent mothers to exclusive breastfeeding.

Methods: An interpretative phenomenological analysis approach was used to examine the lived experiences of 20 exclusively breastfeeding mothers, their age (20-40), were interviewed in Karbala pediatric teaching hospital, from November 2019 to April 2020. Data was collected using a face-to-face, semi-structured interview, and then transcribed in full and analyzed using thematic approach.

Results: Thematic analysis of data uncovered a key theme (mental model) which viewed breastfeeding as a tactile medium. a communicative medium that makes semiotic interactions possible. The need for touch is primary for mothers and infants that explains the importance of early skin to skin contact. Touch semiotically translated by mothers and infants as empathy \ co-feeling, communication of values and meaning that explains the exclusiveness of breastfeeding and continuation. The function of the breastfeeding as a semiotic interface transforms the mothers and infants into a self-determined autopoietic couple, that is, a complex adaptive system. Breastfeeding became a context, spatiotemporal semiotic space where the emergence of motherhood, love, happiness, wellbeing was embodied. The second theme is the function of breastfeeding as a social medium that fulfil the expectation of the family and community about what is like to be a good mother. Third theme stranded for the biomedical model about breastfeeding that viewed it as a physiological medium providing healthy, nutritious, clean milk.

Conclusion: Exclusive breastfeeding is an emergent phenomenon resulting from the intertwining of the mothers and infants as a dyad, that is, as a complex adaptive system. The butterfly effect that trigger this intertwining is the touch, the function of breastfeeding as tactile medium embodied through Kangaroo mother care (KMC) and early skin to skin contact\touch that facilitate the emergence of the motherhood and exclusive breastfeeding as self-determined symbolic process. Using touch as a mental model can reframe the discourse of health care system from medicalization to personalization, from linear thinking to system thinking. This tactile model can be used for scaling up breastfeeding program as response to the calls of WHO to use system thinking for health care strengthening and the breastfeeding Lancet Series that used complexity science to scale up the breastfeeding programs in a complex adaptive world.

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INTRODUCTION

Breastfeeding is one of the oldest practices, recommended in the ancient Hindu scriptures, Holy Quran and Biblical records ¹. Breastfeeding is recognized as the best source of

nutrition for infants. There is a big data about breastfeeding and its healthy impact on both the infants and their mothers. All of these researches agreed that

breastfeeding is the ideal way to fulfil the needs of infants. The World Health Organization (WHO) states that breastfeeding is the optimal way to feed an infant. Therefore, it recommends breastfeeding exclusively up to 6 months of age, followed by breastfeeding with supplementary food for 2 years or more (1-6-24 model)^{2,3}. Exclusive breastfeeding for 6 months has many benefits for the infant and mother. Chief among these is protection against gastrointestinal infections which is observed not only in developing but also industrialized countries. Early initiation of breastfeeding, within 1 hour of birth, protects the newborn from acquiring infections and reduces newborn mortality. The risk of mortality due to diarrhea and other infections can increase in infants who are either partially breastfed or not breastfed at all. Breast-milk is also an important source of energy and nutrients in children aged 6–23 months. These are facts about breastfeeding popularized by WHO and UNICEF creating a positive mental model and attitude about breastfeeding as the ideal food for infants that can provide a healthy milk filled with protective antibodies and nutrients promoting growth and development⁴. Many studies found correlation between breastfeeding and performance on intelligence tests⁵, and the less likely to be overweight,⁶ the less prone to diabetes later in life⁷. Women who breastfeed also have a reduced risk of breast and ovarian cancers⁸. However, nearly 2 out of 3 infants are not exclusively breastfed for the recommended 6 months—a rate that has not improved in 2 decades⁴. There are many epidemiological evidences that supports breastfeeding (BF) as an effective intervention to advance mother–child health. Particularly important is the timely initiation of BF (within 1 hour after birth), exclusive breastfeeding (EBF) for the first 6 months, and continued BF until the child is at least 24 months old (1-6-24 model)^{9,10}. In Iraq, the Ministry of Health was reported that the prevalence of breastfeeding for infants within age six months was 41% in 2014, whereas in 2013 was 44%. There were wide variations between governorates percentages of children who are exclusively breastfed. The percentage of adequately breastfed infants different between Najaf and Karbala (37% and 59 %) respectively¹¹.

In a study about knowledge, attitudes and practices of Iraqi mothers and family child-caring women regarding breastfeeding, it demonstrated that many Iraqi women are familiar with the benefits of BF and believe in some important concepts of BF, such as the early initiation of BF, giving colostrum to their babies, and practicing BF on demand. On the other hand, these women lacked the knowledge of full exclusive BF, its duration, signs of good positioning and latch on, the need to wash hands before BF and the correct time for the introduction of supplements¹². These results were generally consistent with the literature and other studies^{13,14}. The problem in these studies is the reduction of the complex process of breastfeeding experience into a quantitative dimension overlooking the lived qualitative nature of such experience. Most of the research design in Iraqi studies focused on surveys and questionnaire that can capture only quantitative dimension of the experience¹⁵. The

biomedical information about the importance of the breastmilk for both the infant and mother communicated in a way that cannot trigger a self-determination and autonomous behavior which can be embodied as adherence and exclusiveness to these highly important recommendations. Breastfeeding is one of the most effective ways to ensure child health and survival, over 820 000 children's lives could be saved every year among children under 5 years, if all children 0–23 months were optimally breastfed. Breastfeeding improves IQ, school attendance, and is associated with higher income in adult life. Globally, only 40% of infants under six months of age are exclusively breastfed. WHO actively promotes breastfeeding as the best source of nourishment for infants and young children¹⁵. Medicalization of breastfeeding created unintended consequences in framing breastfeeding as milk feeding creating an opportunity for bottle-feeding to win the competition. Biomedical discourse about breastfeeding didn't motivate women to adopt breastfeeding as an exclusive practice and still the rate is below the expectations. Most studies searched for the reasons of failure of exclusive breastfeeding (EBF), I choose less traveled path, I searched for the reasons of successful journey of breastfeeding that transcend the recommendations of WHO, UNICEF. This study focuses on mothers lived experience of exclusively breastfeeding in spite of the presence of seductions of bottle feeding and the interference of breastfeeding with their everyday life as a wife, housekeepers, and sometimes as an employee. I used a qualitative design to understand their lived experience of exclusive breastfeeding and to uncover the shared mental models that create strong boundary against alternative forms of feeding. I will define essential concepts that are necessary for understanding why I choose qualitative design to explore lived experience of adherent mothers using the language of system thinking and complexity science which view life and health as an emergent phenomena resulting from interaction of four systems: biological, cognitive, social and ecological systems. The relationship between these systems are holistic relationship, that is, they are systems and subsystems, whole and part of a whole. This holistic view of life and health is essential premise to understanding the conditions that make successful exclusive breastfeeding possible.

Breastfeeding is a multifunctional process that can fulfil all needs of infants and mothers as described by Maslow's hierarchy of needs including psychosocial needs, semiotic \spiritual \existential needs rather than just the physiological needs that can be fulfilled by bottle feeding. Breastfeeding as a medium for fulfillment of these different needs is a threshold concepts in this study.¹⁶ The fulfillment in modern medicine is an outcome of reductionism of health into the biological domain of life and overlooking other domains like psychosocial and existential one.¹⁷ Unfortunately health care system and medical education curriculum still working inside modern science paradigm that gives primacy for eyes and observation to ensure detachment and objectivity. Touch \subjectivity and closeness are a taboo in modern science,

they are regarded as source of subjectivity and locality. Modern science is a value -free, touch -free, subjectivity free¹⁷. This explain the focus of the discourse of most of the recommendations on the biological health outcomes of breastfeeding, to ensure providing facts for mothers assuming that they will be moved by scientific language. This dominant biomechanical model become a boundary \container of the healthcare system controlling the process of information exchange with other systems .To scale up the programs of breastfeeding in 21st century, we need to cross this solid close container\box of modern science and opening to an alternative mental model \paradigm that can respect all perspectives: that is, the cognitive, the social and the biological¹⁸. The name of this alternative mental model is called phenomenology which is the research paradigm of my study. I used phenomenology as a system thinking paradigm that gives primacy for the process, relationship, semiosis (meaning-making process) which are embodiment of a mental model that constitute human lifeworld. Hence, phenomenology gives the primacy for touch \intersubjectivity\ interconnectivity, semiosis and communication that facilitate emergence of life, health, meaning as complex adaptive system. Both system thinking and phenomenology share the same goal, which is, the uncovering of the tacit mental model of the system\experience that function as a system boundary controlling perception (input) and behavior (output). Mental models can be an intrinsic or socially acquired intentionalities. They are expressed non-verbally or verbally as a sign system which is studied by semiotics. Thus, the aim of this study is to uncover the mental model or the intrinsic intentionality of breastfeeding to ensure using appropriate attitude, knowledge and skills that can induce exclusive breastfeeding.

Breastfeeding is a complex phenomenon that emerge from the interaction of four systems: biological, cognitive, social and ecological¹⁸. Embracing both the qualitative dimension of health and human experience and their qualitative aspect is an essential step for leading systemic intervention. The focus on the biological \somatic benefit of the milk dominate the discourse about breastfeeding giving less attention to the other dimensions like the psychological, social, semiotic \spiritual dimension of the lived experience of breastfeeding that can transform mothers and infants into a complex adaptive system. The meaning complexity is derived from works of transdisciplinary teams of Santa Fe Institute. They define complexity as the inter-relationship, inter-action and inter-connectivity of elements within a system and between a system and its environment. Murray Gell-Mann, traces the meaning of complexity to the root of the word. The root is Plexus that means braided or entwined, from which complexus meaning is derived as braided together^{19,20}. The term complexity is therefore associated with the inter-twining or inter-connectivity of elements within a system and between a system and its environment²⁰. Breastfeeding is the place where inter-twining or inter-connectivity emerge transforming women into a mother. The tipping point that induced this inter-twining is the initial skin to skin touch which function as semiotic

medium that communicate the feeling of motherhood, love and belonging^{21, 22, 23}. This intertwining \complexity between the mothers and infants is understood by phenomenology as becoming flesh , intercorporeal being that facilitate embodiment and consequently becoming interdependent adaptive system that can cope with all difficulties and uncertainties that accompany this process^{23, 24}. I will cover this aspect in depth in the discussion.

Understanding the breastfeeding using system view of health as described by Fritjof Capra is an another threshold theme in my study¹⁸. I applied Capra system view of life \health to breastfeeding which justify understanding this process as a complex adaptive system that can fulfil the different levels of infants needs as described by Maslow motivation model. Maslow described human behavior as a fulfillment of different level of needs: "physiological", "safety", "belonging and love", "social needs" or "esteem", and "self-actualization". Fulfillment of the lower levels is precondition to arise at the next level, each stage must be satisfied before movement to the next. Changing behavior should be correlated with the level of needs that these people inhabited. The goal in Maslow's theory is to attain the fifth level or stage: self-actualization, and transcendence (the ecological\motherhood level)^{25, 26, 27, 28}.

Breastfeeding is more than a milk feeding, it become an extension of the intrauterine life that can provide infants with nutrition, security, safety, love, belonging, attachment making exclusiveness and adherence possible. Breastfeeding function as a complex semiotic process that provide both partners with meanings and values in addition to their physiological function. Breastfeeding become a semiotic tactile medium (non-verbal language) that communicate security, love, belonging and motherhood (self-transcendence) using the language of Abraham Maslow or eco-system using the language of system thinking and complexity science^{19, 22, 29}.

Human beings are complex adaptive system, that is, they are system and subsystems: biological, psychological, social and lastly ecological world. These worlds\systems are interconnected and interdependent, this is what makes human being needs to be adaptive and lifelong learners. This interwoven world best described as complex adaptive systems which implies these different levels of organization. **Figure 1** describe the meaning of being complex adaptive system^{17, 18, 19}.

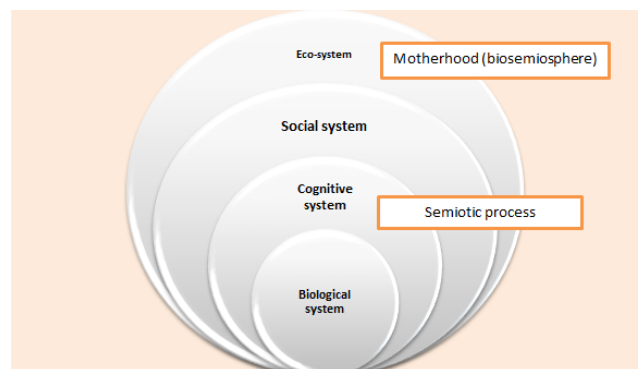


Figure 1. Capra system view of life and health. Complexity science define all living system, including human beings, as a complex

adaptive system.¹⁸ Complexity is outcome of intertwining, interconnection, that is, touch. Touch makes living system whole and part of whole, that is, system and subsystem. Skin for example mediate touch with physical and biological environment while language (semiotics) mediate symbolic touch with social \cultural environment. Skin make living system inside biosphere while semiotic make them inside semiosphere¹. This understanding of skin as semiotic medium called dermatosemiotics.²⁹ Breastfeeding for infant function as biosphere and semiosphere fulfilling all their needs. Only when women become a mother, biosemiosphere, breastfeeding can become a complex adaptive system, that is, self-determined process.

Exclusive breastfeeding is an emergent phenomenon. It is sign that the infants and women become a whole and part of whole, that is, transformed into a complex adaptive system, eco-system, using the language of system thinking, sacrificing their egoistic needs to fulfil the needs of their infants¹⁹. This ecological level of being is called by Abraham Maslow self-transcendence, where one finds the fullest realization in giving oneself to something beyond oneself-for example, in altruism or spirituality. He equated this with the desire to reach the infinite²⁹. Self-transcendence or being a mother refers to the very highest and most inclusive or holistic levels of human consciousness, behaving and relating, as ends rather than means, to oneself, to significant others, to human beings in general, to other species, to nature, and to the cosmos"^{28,29}.

Breastfeeding as complex adaptive process can fulfil both the basic needs of infants and the growth need of the mothers. This is one of the most important findings in our study that explain the conditions that make adherence and exclusiveness to breastfeeding possible, which will be discussed fully later on. Maslow's hierarchy of needs is metaphorically presented as a pyramid with the basic, most fundamental needs at the bottom while the advanced Being\growth needs like self-actualization and self-transcendence at the top. Maslow hierarchy of needs assume that individuals' most basic biological needs must be actualized before they become motivated to achieve higher level needs as shown in Figure 2.^{25, 26, 27, 28, 29}

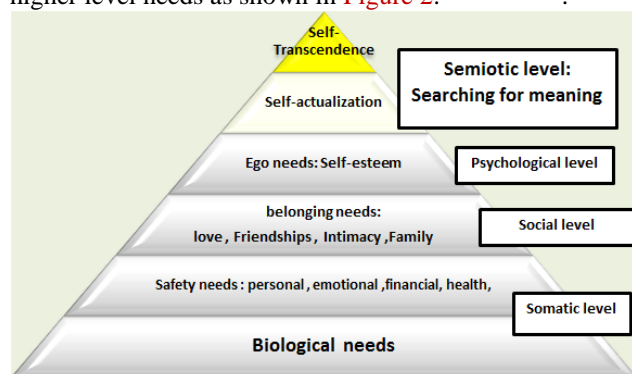


Figure 2. Human beings as complex adaptive system. We are inside four system: biological, cognitive, social, and ecological system. Each

¹ Semiosphere is the sphere of semiosis in which sign processes operate in the set of all interconnected lifeworld. The concept was coined by Yuri Lotman in 1984 and is now applied to many fields, including cultural semiotics generally, biosemiotics, zoosemiotics, geosemiotics, etc. The concept is treated more fully in the collection of Lotman's writings published in English under the title "Universe of the Mind: A Semiotic Theory of Culture"(1990). From Wikipedia

system has a function, a need, an intentionality that define its semiotic boundary controlling what is inside (perception) and what is outside (behavior and interactions).

Using Maslow framework and Capra system view of life helped me understand motherhood as a form of self-transcendence, ecological thinking respectively. My mental model about breastfeeding is transformed from biomedical model to phenomenological model that gives primacy for touch, semiotics and communication rather than just milk feeding .The infants need for milk can be provided by bottles but their needs for touch, that is , semiotic needs for security, belonging, love and wholeness , is impossible without the breast^{20,21}.

Therefore, health care professionals need to be aware of the mental model they share about health and breastfeeding to ensure authentic relationship with patients fulfilling the call for person centered medicine that give primacy for patient's perspective and needs. In this paper, I chose the phenomenological model as alternative to biomechanical model that dominate our life till now³⁰. Phenomenological model gives primacy for first person-perspective, the lived experience of breastfeeding that is, adopting empathy and I-You relationship and hence avoiding the detached stance of modern medicine that adopted a third person perspective, that is, I-it relationship^{30,31}.

Bottle feeding is sign of being inside modernity that give primacy for I-it relationship in which the infants received value -free milk, disembodied feeding. This can explain the association of autism in those who did not receive embodied feeding, that is breastfeeding, which transform infants into a person, a living system, that is, approaching them from the I-You perspective. Breastfeeding is I-You relationship that provide empathy and mutual love which facilitate emergence of holistic health and wellbeing³¹.

Phenomenology as a qualitative research paradigm is a strong ground for planting humanistic psychological models as embodied by Abraham Maslow and the system thinking model as embodied by Fritjof Capra and lastly biosemiotic model as embodied by Sturmberg, JP and Shahram Rafieian.^{32,33,34} First of all , I will define what I mean by the term semiotics and biosemiotics , then I will integrate these definitions with my understanding of breastfeeding as complex semiotic process .

What is Semiotics?

Semiotics is a science that studies signs system like living systems, artificial systems like computer, culture, communication (verbal and nonverbal). A sign is something which stand for something else – in other words, a sign is anything that can convey meaning. Words can be signs, drawings can be signs, photographs can be signs, the traffic signs. Behavior of all living systems are signs. Even the clothes, the kind of car we have, or even where we live can be used as a sign, as long as they embody a meaning. Understanding is possible only when we see the meaning that made something stand for us. Standing imply underlying ground that make it possible. Semiotics is searching for the this ground that make standing possible .Thus, everything need a ground to stand on to appear, to be perceived. This ground is called

signified in semiotics and intentionality in phenomenology, theme in qualitative research, and mental model in system thinking which make understanding, interpretation and perception possible^{21,22}. Human beings are symbolic species, they are driven by a need to sense-making: above all, we are surely Homo significans - sense-makers.

Regarding biosemiotics, it is defined as the study of signs in living systems. Its major claim is that life is semiosis, i.e., cognitive process that transform input into output. Biosemiotics is a new science of living, a new paradigm for biology, its new theoretical framework which should lead us to deeper understanding of life^{22, 35, 36}.

In summary: anything can be a sign as long as someone interprets it as referring to something - or standing for something other than itself. Semiotics is embodied intentionality, embodied mind²⁷. I will use Saussure a 'dyadic' or two-part model of the sign. He defined a sign as being composed of:²¹

- The 'signifier': the physical form which the sign takes; (the medium).
- The 'signified': the mental concept it represents (the message).

Sign is a complex adaptive system (complex whole) that emerge from touch between physical aspect of experience (the signifier) and the mental aspect of the experience (the signified). The relationship between the signifier and the signified can be systemic (intrinsic) or conventional (socially constructed)^{21,27}. Therefore, there are three categories of signs:

- Indexical Signs: signs where the signifier is caused by the signified, e.g., smoke signifies fire. This kind of sign is studied by natural science and modern medicine.
- Iconic signs: signs where the signifier resembles the signified, e.g., a picture.
- Symbolic (arbitrary) signs: signs where the relation between signifier and signified is purely conventional and culturally specific, e.g., natural language (words) and mathematical language (numbers)

Now, we can understand the meaning of breastfeeding as biosemiotics process which embody different meaning for different persons. Breasts can be viewed as index, icon and symbol. The breast as an indexical sign, it functions as semiotic boundary that differentiate those inside mammalian species from others and differentiates the female from male, thus, it contributes to the relational identity formation and gender. Thus, breast is index of being a female. Breast as iconic signifier, it stands for beauty, sexual appeal and aesthetic. This explains its great importance for women when it is affected by a cancer or when women become a mother. Breastfeeding affect iconic function of the breast and become symbol of motherhood, a new identity that change the meaning of their breast enabling them to practice breastfeeding publicly without feeling of shame or embarrassments. Unfortunately, breast used as sexual erotic object and marketed through movies and media in away make it difficult for the symbolic meaning of breastfeeding to emerge. The meanings embodied by breast for infant as a

medium for living touch\connection, security, love, belonging, motherhood is tipping point in triggering relationship between them as complex adaptive relation that make exclusive breastfeeding autonomous and self-determined. The attitude of the women to the breastfeeding is outcome of the meaning they had about the breasts. As I said before, breasts can be a sign of feminine identity and sexuality, or motherhood identity and self-transcendence. The way breasts are given to the woman define their attitude and behavior towards breastfeeding and adherence. Understanding this semiotic dimension of the breastfeeding experience can fill the gap created by the medicalization studies that reduced the breastfeeding into a biological feeding product forgetting the symbolic nature of human beings and breastfeeding. Against such background, we can understand the rationale behind choosing Interpretative phenomenological analysis (IPA) as semiotic stance that give primacy for connection, meaning, touch and complexity which is best summarized by Joachim P. Sturmberg somato-psycho-socio-semiotic model that ensure integration of all already mentioned models^{32, 38, 39, 41}.

Human experience in general and health experience in particular are an emergent phenomenon resulting from the semiotic interaction among four interconnected systems: biological (somatic), cognitive (semiotic), psychosocial and ecological systems. Joachim P. Sturmberg introduced new version of medicine grounded in complexity science and system thinking which is the best model that can provide radical cure for the wicked problems that pervade health care systems and its outcomes^{32, 38}. He says: The somato-psycho-socio-semiotic model of health describes health as the experience of a relative balance resulting from the dynamic interactions between the biological, emotional, social and sense-making (cognitive) dimensions affecting the individual person in all of his/her context (Figures 3 and 4)³².

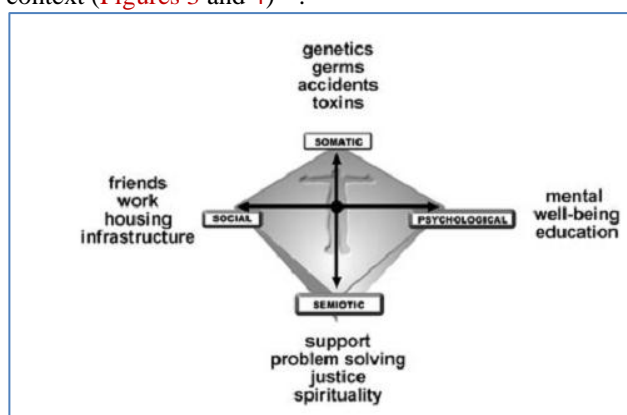


Figure 3. The Somato-Psycho-Socio-Semiotic Model of Health produced by Joachim P. Sturmberg that fulfil the intentionality of the system view of life as expressed by Fritjof Capra and dermatosemiotics as used by Ali Tareq^{19, 27, 32}.

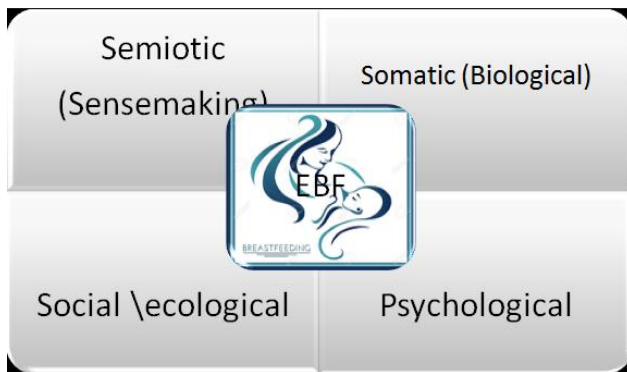


Figure 4. Exclusive Breastfeeding as complex adaptive system in which the infant and their mother function as single system fulfilling different levels of needs: biological \somatic, social, psychological and semiotic (spiritual) needs. The butterfly of this complex system is early skin to skin touch that trigger emergence of motherhood as complex semiotic process.

Applying this model to the experience of breastfeeding can integrate all the efforts and studies into transdisciplinary teams who can view this complex process from these four dimensions. In our study we use Interpretative phenomenological analysis (IPA) to explore the semiotic dimension of the experience which embodied as themes^{42, 43}. These meanings will be disclosed using as in-depth interview and empathetic listening. The breast as a symbol, function as a semiotic interface for attachment and bonding, motherhood and unconditional love that transform the mother and infant into a complex adaptive system.

Breastfeeding as Tactile medium:

Touch is our most intimate and involving form of communication and helps us to keep good relationships with others. That is why we use expressions like "Let's stay in touch," "I'll contact you when I get back," and "I was touched" "by what another person said or did."

Stanley E. Jones

The act of touch fulfills the basic human need to feel safe, comfortable and loved.²⁰ Touch function as non-verbal communication that people use it as metaphor for defining the degree of closeness and distance. Touch is an effective way to communicate emotions and to create social bonds. It is also one of the key mediators of early parental bonding^{44, 45}. Understanding touch as no-verbal communication is threshold concept in this study. Biomedical model gives the primacy for nutritious function of breastfeeding as biological medium that communicate just the milk to the infant. My aim in this study is to disclose the function of the breastfeeding from mother's perspective. Thus, this study is an attempt to answer the question about which one is the primary need for infants and mothers, touch or milk. Breastfeeding is understood in this study as a tactile medium that communicate meanings and values while Bottle-feeding provide only milk in detached way. Bottle-feeding can't win the battle with breastfeeding if the function of breastfeeding is reframed as a semiotic border for touch and motherhood rather than just feeding machine. The

psychoneuroimmunological effect of touch is beyond dispute as it is grounded in a solid evidence-based literature which is difficult to be covered in this paper, nerveless, I am obliged to share with you this short account about the primacy of touch from both biological and phenomenological point of view^{27, 46, 47, 48}.

The anthropologist Ashley Montague (1995) believes that touch is adaptive in evolution as a form of social communication that can cross species, cultures, genders and age groups. He suggests that without touch there may be growth failure (as found many years ago by Rene Spitz and more recently in Rumanian orphans)⁴⁹. Numerous studies from various fields have established that touch is vital to healthy adjustment during infancy and also during old age. Biological studies confirm the correlation of touch to the physical and psychosocial systems⁵⁰. The role played by tactile experiences in social development is increasingly recognized in recent literature⁵¹. Maternal touch has been found to be effective in promoting social bonding⁵², behavioral stability⁵³ and emotional regulation⁵⁶. Additionally, there is evidence that maternal touch promotes responsiveness to and engagement with the caregiver⁵⁷.

Maternal touch is a threshold concept in infant development, conditioning emergence of social reward, attachment, cognitive, communication, symbolic interaction and emotional regulation throughout life.

A light inter-personal touch can also elicit positive feelings, generosity, and compliance^{56, 57, 58, 59, 60, 61}. Interpersonal touch regulates social relationships from infancy onward⁶². Tactile stimulation is a part of the typical repertoire of mammalian caregiving behaviors^{63,64}. Touching and being touched is crucial for bodily and neuro-cognitive development in humans and in non-human primates^{13, 65, 66, 67}. Interpersonal touch reduces infants' response to stress³¹ and enhances social learning³². Furthermore, the quality of tactile interactions between caregivers and infants has important long-term social consequences, influencing the formation of bonds and attachment behaviors throughout the lifespan^{68, 69}. Social touch plays a powerful role in human life, with important physical and mental health benefits in development and adulthood. Touch is central in building the foundations of social interaction, attachment, and cognition^{70, 71}.

The importance of touch is best exemplified by Kangaroo mother care (KMC) which is introduced as a holistic intervention given for all newborns especially for premature and low birthweight (LBW) infants^{72, 73}. It is based on three elements: kangaroo position (skin-to-skin contact between mother and infant), breastfeeding; and timely discharge with close follow-up⁷². It is a preferred intervention for decreasing neonatal morbidity and mortality in developed and developing countries, and suitable for use in all settings⁷².

MATERIALS AND METHODS

In this qualitative study, I used interpretative phenomenological analysis (IPA) as a methodology and a method which is a suitable stance and tool that explore the meanings and feelings lived by a mother helping

them to make sense of their breastfeeding experiences, that is, their symbolic interactions. Phenomenology as a qualitative stance facilitates empathy and active listening as if being inside the mother's skin, that is, their lifeworld making mutual understanding and fusion of our different horizons of expectations possible. IPA as research paradigm is a relational semiotic stance that gives primacy for touch \ intersubjectivity , interconnection , complexity and uncertainty. IPA as method views participants stories as a text that need to be read and interpreted. Thus, the interviews with the participants is inherently a semiotic interaction before being symbolic one. What I mean by semiotic interaction, is the non-verbal dimension of communication while the symbolic interaction stands for verbal communication. Jonathan A. Smith, the founder of this qualitative design defines the aim of interpretative phenomenological analysis (IPA) as:⁷⁴ "To explore in detail how participants are making sense of their personal and social world, and the main currency for an IPA study is the meanings particular experiences, events, states hold for participants. The approach is phenomenological in that it involves detailed examination of the participant's life-world; it attempts to explore personal experience and is concerned with an individual's personal perception or account of an object or event, as opposed to an attempt to produce an objective statement of the object or event itself."

In general, phenomenology started with semiotic analysis as done by Edmund Husserl in his magnum opus: logical investigation. Making sense is called semiotics in this study, this is what make semiotic phenomenological analysis can be used as alternative name for this design^{75,76}. Phenomenology is a relational attitude, that is, I-You relationship that gives primacy for others, for their lifeworld, thus it adopted empathy as methodology and method. is outcome of bracketing our egoistic attitude and preconceptions and assumptions about the studied phenomena⁷⁷. Empathy is embodied as active listening, as being inside the participant's skin, that is, their lifeworld making shared understanding possible. Qualitative research gives the primacy for participants lifeworld and their voices rather the discourse of the biomedical worlds .Bracketing our medical stance and my prejudgments about breastfeeding experience as pediatrician is done before starting the interview, making me in touch with participants skins in way that transform my lifeworld as a doctor. The participants disclose their lived experiences after ensuring that we are inside their lifeworld, disclosing the essential meaning lived by participants as themes or mental models, these models are the themes which are categorized using logic of whole and part as developed by Edmund Husserl and used by complexity science as system thinking^{78, 79}.

Participants

Participants (n=20) age (20-40) were met Karbala pediatric teaching hospital from November 2019 to April 2020. After taking informed consent, semi-

structured interviews were employed and lasted approximately (30-40) minutes. Women were asked demographic questions about themselves and their infants, as well as questions about the motifs and the resources that informs their decisions to choose breastfeeding as feeding choices which include (while pregnant and after delivery , the difficulties that they face due to lack of knowledge and skills or social duties and lack of support). I can summaries my questions that guide my interview as follows:

- 1- How breastfeeding made the women feel and how they made sense of their experiences.
- 2- What is your attitude towards breastfeeding, if positive and negative, why they feel like this?
- 3- What are the meanings and thoughts they have about breastfeeding and from where they receive them?
- 4- How do they feel while nursing their infant, what is the effect on their infant?
- 5- What is the attitude of the surrounding people towards their breastfeeding practice?
- 6- How they view themselves after the first time they breastfed their infant, how they feel towards their self.
- 7- Is breastfeeding beneficial for them or only for infant.
- 8- Are they afraid from changes in the appearance of their breast and their self-image as attractive wife?
- 9- Do they feel competent in doing breastfeeding and capable of coping with the side effects of breastfeeding which can transform it into painful experience?
- 10- Are they intrinsically motivated and self-determined or just breastfed their infant to meet the expectations of their family and spouse?

These were used as prompts to reveal the meanings, thoughts, feelings, and attitudes towards breastfeeding that control mothers' intentions to initiate and continue breastfeeding and in addition to the barriers that can impede this process. These prompts also gave the interviewees a chance to attribute meaning to their experiences, giving a richer interview response. Audio recordings were transcribed and the data analyzed using inductive thematic analysis, and no judgments were made about the data before coding.

The inclusion criteria used in this study are:

- 1- Multigravida, a mother with a pervious successful experience with breastfeeding may influence the decision and adherence to breastfeeding.
- 2- Primigravida, who breastfed her infant exclusively for at least 6months. (according to the WHO, this period is advised minimally for breast feeding).
- 3- Women delivered after term (37week of gestation or more), and the birth weight of their babies was 2.5kg or more. (prematurity represents an additional challenge of nutrition for the mother because of absence or weak sucking and\or swallowing related to immaturity).
- 4- Mothers able to provide informed consent.
- 5- Mothers able to understand and communicate with Arabic language or English.

The Exclusion criteria used in this study are:

- 1- Baby required NCU or INCU after birth.
- 2- Mothers with past surgery of the breast. (it may affect the process of breast feeding).

RESULTS

Three master themes were identified as important to understanding the lived experience of mothers who breastfed exclusively for more than 6 months. These themes were:

- Breastfeeding as a tactile medium that facilitate the emergence of the identity of motherhood, feeling of love, connection and attachment embodied as joy and happiness.
- Breastfeeding as a social medium that transform nursing mother relations to their husband, family and the public space in either positive or negative way according to the expectations of such relational partners.
- Breastfeeding as a physiological medium that fulfil the needs of the infants for clean, healthy milk ensuring positive immunity, good growth and development.

1-Breastfeeding as tactile medium

Most of the studies about Breastfeeding focused on the breastfeeding as a physiological medium that communicate milk to infants while overlooking its tactile power of communication of connection, caring, love, compassion and motherhood. This qualitative study of breastfeeding experiences revealed the primacy of touch for both mothers and infants which is embodied in verbally and non-verbally. I choose few quotations from the interview transcript to demonstrate this finding. In the following citations are from the semi-structured dialogue with nursing women who adhere exclusively to breast feeding that confirm this theme:⁸⁰

When I breastfed my child , I felt he is still inside me , part of me , dependence to the degree that make me ready for sacrifice all my connections that make me disconnected from him .When he cried , I cried with him , I become one with him , and breastfeeding fulfil this oneness for me , making me in such close touch to feel of fulfillment and happiness .I gave him a milk but he gave me a breastfeeding that make tolerate all obstacles associated with breastfeeding .I loved breastfeeding and enjoyed as a gift .(participant 1)

Understanding breastfeeding as a continuation of a pregnancy ,in which mother still hold the baby close and responsibly completely for his nourishment .Breastfeeding function as extrauterine life for the baby , giving them the same feeling of safety ,security and belonging⁸¹ . They feel they are inside their mother , this feeling is what make women struggle for making breastfeeding continue as long as possible crossing the recommended period .This empathic stance of mothers towards their babies immunized mothers towards the seduction of the media and advisements about bottle feeding and its ability to provide babies with vitamins and mineral. They understood that their babies need

more than the milk, they need to return to their womb, their warm skins, smell, their eyes contacts, all these contribute to the wellbeing of both infants and mothers and promote the development of the infant social brain which decreased risk for autism and low IQ. Reductionism of the needs of the infants to the breastmilk is a strong factor leading mothers to bottle feeding and early weaning. Other women expressed their lived experience of breastfeeding, she confidently and affectionately said:

"I am proud that I took this choice to feed my child from my breasts and in spite of the discomfort and pain that accompany this experience, it is still ultimately the most beautiful, tender feeling ever lived. Putting my baby in my lap and looking in his eyes, and seeing his smile with eyes glowing with happiness making me cried from joy " (participant 4)

Mother in this description confirm the dialogical nature of breastfeeding as a symbolic interface connecting the mothers to infants and ensuring feeling of wholeness and happiness. Motherhood is lived as dialogical interaction that emerge at every breastfeeding event .Breastfeeding for this women lived as psychotherapy of everyday suffering , as they enter in flow state using the language of positive psychology. These benefits include improved mood and stress levels in the mother, lower risk of postpartum depression, enhanced social emotional development in the child, stronger mother-child bonding and more is well and deeply studied from both biological and psychosocial perspective^{82, 83} .

I can say—from my personal experience—that Breastfeeding act as liminal space , transitional border that can solidify the meaning of being a mother .This liminal experience not lived in the same way by all women. Those who are not prepared psychosocially for function as a mother will be horrified by this new emerging identity that can deprive them from all the freedom that they experienced as independent individual .Breastfeeding transform individuality into a new form of being in which the mother and infant become interdependent, interconnected as a complex adaptive system using the language of complexity science. This complexity is embraced by all the women interviewed in this study as they felt happy and fulfilled of their need to a mother. This is the meaning of the function of breastfeeding as a symbolic medium providing meanings and feeling in addition to its function as biological medium providing infant with milk. The success of our in-depth interview is a result of bracketing the biomedical stance that reduced breastfeeding to milk feeding even if they add another benefit, but the master theme for them is the breast as milk provider and overlooking the mother lived experience. One of participants expressed this theme in clear way:

"With a beautiful smile on her face while describing her the first meeting with her baby:" I walked towards the unit where they care for my newly born baby , as I waked I had mixed feeling I was anxious, happy, eager to see my baby , doubts about my ability to breastfeed

my baby but I was determinate to do whatever it takes to succeed .I fell in love with my baby once he started touching my breast and feeding , my feelings were overwhelming . No words can describe this moment. (participant 3)

The lived experience of this mother can be understood using the concept of self-actualization as described by Abraham Maslow²⁶. Maslow description of self-actualization as peak experience translate mother verbal and non-verbal experience of first meeting with their baby through breastfeeding. Maslow describes peak experiences as transcendent moments of pure joy and elation. These are moments that stand out from everyday events. The memory of such events is lasting and people often liken them to a spiritual experience.⁸⁴ Breastfeeding as semiotic interaction facilitate the emergence of motherhood as peak experience ,a self-transcendence. Women tolerate the ambiguity of the feeling and the novelty of the experience with all its negative consequences on her other identities as a wife, job worker , attractive female for this feeling of being a mother that can sacrifice everything for her baby . The final contribution to this theme is added by this forth participants:

"I love breastfeeding because I deeply believe that I has major effect on connecting me strongly to my baby, and that the baby will grow feeling love, care, and belonging" (participant 11)

2-Breastfeeding as a social medium

Adherence to breastfeeding among the interviewed participants attribute to the underlying social structure that define horizon of expectation about what is like to be a good mother. This theme is expressed clearly by mothers living inside the rural areas where the social structures are strong enough to be internalized as a natural structure. Rural culture gives the primacy for the mother role over other roles like being an employee or other social roles. I will share with you the words of these mothers who confirm the presence of such a theme:

"My husband and his family -as we live with them-encouraged me to breastfed my baby ,they helped me a lot in doing the home duties like cleaning and cooking .I felt greatly supported and secure, this was very important for making me feel comfortable , I believed also this feeling of support and comfort increased the amount of my milk" ((participant 20)

"My mother in law is highly concern about the type of food I should eat, or avoid. she advises me to eat diets, diet syrup .and sweets to increase the milk, also to avoid some food like okra, cucumber which can cause gases and colic to the child "(participant 12)

"I found myself supported from my family and neighbors, they encouraged me to be exclusive to the breastfeeding as it is seen as a sign of being a good mother, caring only for the health of my babies. This feeling is what make my breastfeeding a moment of joy and happiness without being shamed or embarrassed by

people gaze when I obliged to feed my baby outside my home. (participant 18)

The social expectation towards breastfeeding is different from the urban life to the rural life, from western culture to eastern society. This issue is not the focus our study, as the aim of this study is to give voice for mothers to express their own feelings and thought about their lived experience of breastfeeding creating space for emergence of their autonomy and self-determination. This explain the secondary importance given -by the participants- to these external forces: social expectations, economic and financial issues, and religious doctrines. In this study , the central theme that function as boundary and threshold for emergence of exclusive breastfeeding is the need for touch , communication with their infants to ensure giving them feeling of security, motherhood, kindness and compassion .

3-Breastfeeding as a Biological medium

This theme is a shared theme among participants and health care professional. It represents the focus of WHO and UNICEF in promoting breastfeeding as the best way to feed infant especially for the first 6 month. This information is available to most patients and they inform me about as if it is the only meaning behind breastfeeding. This biological function is impersonal theme as it lived by all animals rather than just human beings. Here, few quotations from participants scripts show their focus on this biological function of breastfeeding and comparing it to bottle feeding as if they are comparable.

I did have some nice information about breastfeeding in this hospital (pediatric hospital as her daughter was admitted for jaundice to receive phototherapy), The doctor and nurses told me about many benefits of breast feeding including that good breast feeding can help decreasing my babies' jaundice" (participant 12)

This is the main language that is used by health care system, which is breastfeeding is milk feeding rather than as holistic experience irreducible to its parts.

Another participant tried to confirm the view of breastfeeding as medical intervention, she added:

"The bottle can be a source of infection, it caused diarrhea to my previous child, which lead to dehydration. she was admitted to the hospital for many days. I decided then to breast feed may following child. Never give bottle again "(participant 16)

This theme is best embodied by this participant

"Sometimes the mother leaves the child on bottle feeding in the hand of the caregiver. They are not me I am not sure that they will clean the bottle properly or use clean water for the formula. the bottle will be contaminated by bacteria or yeasts, certainly this will put may child at risk of infections and disease. (participant 11)"

This participant give primacy for this medical model or theme in choosing breast feeding as a pattern, as regular, exclusive practice:

"Formula milk is not suitable for my baby because of its artificial composition and every company puts down its own ingredients therefore I had to change the formula many times ,some caused her vomiting some caused constipation ..so this is one of the reasons that made me determinate to breast feed the second child exclusively and I did "(participant 11).

DISCUSSION

The use of complexity science and system thinking as theoretical framework in this study is congruent with the call of WHO in 2009 for using them to strengthening the health systems and the 2016 Breastfeeding Lancet Series that used complexity science to scale up the breastfeeding programmes in a complex adaptive world^{85, 86}. The kind of thinking used in system thinking and complexity is thinking at the level of the whole , the lived dimension of the experience. The whole is more than the sum of its parts , as it emerge from the semiotic interaction between and \or among the parts .In system thinking paradigms, the whole is lived as emergent theme or phenomena. Exclusive breastfeeding according to system thinking paradigm is an emergent phenomena resulting from the semiotic interaction mediated by the early skin to skin touch between the mothers and infants transforming them into complex adaptive system .This is why the whole is more than the sum of its parts .This explain the importance of the initial condition in the breastfeeding which has a butterfly effect as defined by complexity science and chaos theory⁸⁷. In this study we will highlight these dimensions using IPA as our system thinking methodology and method^{88, 89}.

Although breastfeeding provides infants with both short- and long-term benefits, in addition to the preventive role in breast and ovarian cancer to the mothers, breastfeeding still suboptimal, globally. Black *et al.*, (2013) estimate that optimal breastfeeding has the potential to prevent over 800,000 deaths annually in children under the age of five. The mortality-reducing gains from exclusive breastfeeding are also large: children are on average 14 times less likely to die in the first six months after birth, and their risk of contracting diseases like diarrhea and acute respiratory infections falls significantly⁹⁰.

Report on the situation of infant and young child feeding in Iraq, prepared by Geneva Infant Feeding Association (IBFAN – GIFA), reported that in 2011, only 2 children out of 10 were exclusively breastfed during the first six months of their life (20%). This low rate explained mainly by a lack of appropriate knowledge about optimal infant and young child feeding practices. A research conducted in 2010 in Erbil shows that 41.1% of mothers don't know that children under the age of 6 months need exclusive breastfeeding⁹¹. In 2011, In Iraq, only 23% of children were breastfed until 2 years of age, despite the official recommendation of WHO on continued breastfeeding and the fact that, being Muslim, most of mothers knew that child needed continued

breastfeeding until 2 years of age, as this is mentioned in the Quran⁹².

Different kinds of barriers including misperceptions and inappropriate marketing of breast milk substitutes, inadequate support for breastfeeding remains a challenge in many settings. Against such a background I did my second research on breastfeeding, in the first one I used a quantitative approach to answer the question about the factors associated with maternal preference for bottle-feeding than breastfeeding. In this study I found that the main causes behind this shift to bottle feeding were physician's advices, believe of inadequacy of breast milk and the idea that bottle feeding will increase body weight of baby. During my research I found a group of women who were immune against such factors, they continue using their breast exclusively for feeding their babies ignoring all these ideas and advices. I was very interested to know what make them such resistant and immune to the seduction of bottle feeding. I did literature review for such adherent women and I found different answers, some convinced me and others didn't. I decided to go back to the mothers themselves and listening to their stories from their mouth .The stories I heard and transform my mental model about breastfeeding from biological process to semiotic (meaning-making) process. The feeding is more than just a milk feeding ,it is feeding of security ,trust , love , belonging and motherhood. The focus of biomedical science on the breastfeeding as physiological function create opportunity for bottle feeding to enter the competition. Breastfeeding studied by biomedicine using third-person perspective which objectify the breast as an instrument, that is as a milk-producing machine. The shift from product thinking to process thinking is the essential theme in my study that view breastfeeding as complex adaptive system. In this paper, I seek to rethink breastfeeding from different perspectives than those usually offered by biomedical sciences which use linear thinking that reduced the complex whole into a single, in our case, reduction of breastfeeding into milk feeding overlooking the symbolic nature of human interactions. I will use complexity science and system thinking as framework to discuss my findings. Hence, I will start with the first theme that transform breastfeeding into complex adaptive system.

Breastfeeding as complex adaptive system:

Kevin Dooley, defined Complex Adaptive System (CAS) as a group of semi-autonomous agents who interact in interdependent ways to produce regular behavior \ patterns, which influence behavior of the agents. Life , health are emergent phenomena resulting from interaction of different levels of organizations \scales: biological , cognitive , social and ecological .This systemic view of life and health can be applied to the breastfeeding as a complex adaptive system, that is, irreducible to any part of this experience which is outcome of interaction of these four systems. Human beings' actions or perception is an emergent phenomenon, that is, an outcome of interaction of all these subsystems, or scales. Cognitive system function

as cybersemiotic system. Figure 5 explains the function of cognitive system as semiotic process that transform perception into action, input into output. Mental models or themes are embodied as semiotic process that control participants behavior. Motherhood as mental model function as semiotic boundary controlling what is meaningful and what is not. Only infant health and wellbeing is seen when participants where inside motherhood mental model.

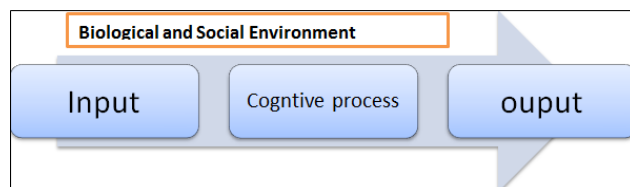


Figure 5. Living system as complex adaptive system. The connection of the living system to environment is mediated by a membrane at microlevel and a skin at macrolevel. Skin or membrane make living system whole and part of whole, that is, complex system. Cognitive process communicates to the outside using signs and signals. Biological skin function as a semiotic interface connecting living system to the eco-system while human language function as symbolic skin connecting them to a social system.

Cognitive system uses signs system to read the relevant stimuli and selecting it as input and using mental models, intrinsic or acquired, to process them into an output (behavior).⁹³ The difference between human beings and other living systems is their ability to be aware of their mental models and changing them if become source of dysfunction. This ability to recognize their mental models is an outcome of self-awareness and metacognition ⁹⁴. This metacognitive capacity makes human beings more complex than all living systems, as it become too difficult to predict their perception and action. We can access this level of cognition using qualitative research methods like interpretive phenomenology IPA. The origin of patterned behavior in human systems is the presence of such mental models which are unconsciously acquired through socialization and education. These shared mental models can ensure regular, expected behavior of the individuals of community making. In this study, I found that all participants who were adherent to breastfeeding exclusively and in few of them more than the recommended period, share the same mental model about breastfeeding as existential process that transform them into a mother making this process a time for fulfillment and self-actualization. Happiness, wellbeing, and feeling of connection are outcome of this symbolic response to the infant as a part of them. This finding is consistent with research done by Lina Palmer *et al.*, they say.⁹⁵

This finding is expressed in this study through the first theme in which mothers described their breastfeeding as semiotic medium for emergence of the meaning of their identity as mother and feeling of being in touch with their babies as if they are inside them.

The crisis in medicine which is embodied as poor patient-doctor relationship, and the commercialization of health

care services is outcome of the mental model that is adopted from modern science, which gives primacy for physical relation and linear causality suspending the subjectivity, need for meanings and values from this model. James Marcum gives a clear description of this mental model that pervade both scientific community of practice and the culture since 19th century until now: He says ³⁰

“The predominant model of the body in modern western medicine is the machine. Practitioners of the biomechanical model reduce the patient to separate, individual body parts in order to diagnose and treat disease. Utilization of this model has led, in part, to a quality of care crisis in medicine, in which patients perceive physicians as not sufficiently compassionate or empathic towards their suffering. Alternative models of the body, such as the phenomenological model, have been proposed to address this crisis. According to the phenomenological model, the patient is viewed as an embodied person within a lived context and through this view the physician comes to understand the disruption illness causes in the patient’s everyday world of meaning.”

Adopting phenomenology as qualitative research design and a relational ontological stance is an antidote against this positivistic thinking that gives primacy for material dimension of experience, objectifying it as independent, context free, value-free substance. This is the root of failure in most reforms in health care system and health promotion programs. They are still working inside substance ontological stance that reduced health into biological system and giving secondary position for other health determinants. The radical cure is given by shifting to complexity science and system thinking in which relations and touch are primary. In this system thinking model human beings are viewed as embodied mind rather than body and mind. This new mental model is grounded in phenomenology that gives primacy for touch, connection, communication, rather than detachment and separation. Social autism is an outcome of modernism with its substance ontology that reduce the life into a physical dimension, creating distance between the observe and the observed. The will to power and control is the underlying motif that make modern medicine adopted such depersonalized approach that are for the diseases more than the person who have the diseases. Breastfeeding is medicalized to the degree that is reduced into just milk providing. The biomedical model is blind to subjective, existential, symbolic dimensions of this complex process. This explain the adherence of those participants to breastfeeding in an exclusive way, as they had different mental model -from that of modern medicine- about breastfeeding that gives primacy for touch, feeling and connection. They lived breastfeeding as opportunity for fulfilling these meanings rather than just reactive response to the infant’s need for milk. They were proactive rather than reactive. This explained why they lived breastfeeding as joyful, pleasurable experience that transform their mode of being.

Fortunately WHO has adapted system thinking as framework to strengthening health care systems and this inspire me to apply it in my understanding of the reasons behind exclusive breastfeeding among mothers, searching for the mental model that make such adherence possible. I used system thinking iceberg model to understand and solve the problem of breastfeeding and translating the findings in qualitative research language .The threshold concept that I found in this qualitative study is that breastfeeding is complex adaptive system , it is more than the sum of its parts , it has different levels of organization: biological, semiotic (phenomenological) , social and ecological levels .The relationship among these levels is following the logic of a whole and part of a whole, that is , a system and subsystem .Touch between these subsystems make them function as complex adaptive system .Hence , early skin to skin touch can be regarded as the condition that make breastfeeding emerge as sustainable relationship embodied biologically through neuro-hormonal changes, for example, oxytocin ^{96, 97} . The phenomenological correlate of these neuro-hormonal changes is the theme one in our study which is the function of breastfeeding as dermatosemiotic interface, that is, semiotic border that unite the mother and her baby into affectionate relationship. Lancet series adopted complexity science as new model for scaling up breastfeeding promotion which views it as complex adaptive system. Understanding breastfeeding as a complex adaptive system, that is, composed of multiple agents working inside different structures: biological, psychological, social and ecological structures. I used the experience of iceberg as a metaphor to stand for the complex adaptive system as shown in the **Figure 6** :^{98, 99} .

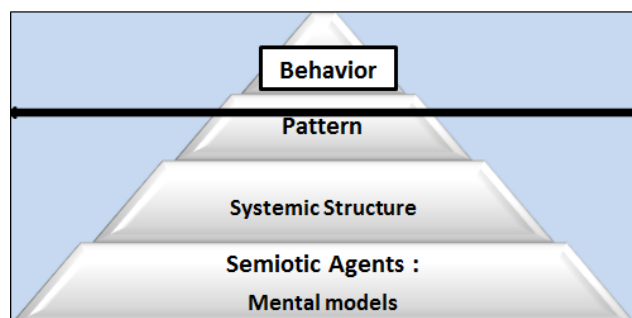


Figure 6. Complex adaptive system as Iceberg model. All living system are example of CAS. The Behavior of such system is an emergent phenomenon which can't predicted by even fully know the underlying structure as long as there are multiple cognitive agents interact semiotically.

I interviewed the participants creating a dialogical space for the emergence of the tacit meaning of their lived experience of breastfeeding that function as a mental model or mental frame that control their perception and behavior towards this experience. These mental models were embodied as an attitude and behavior towards their infant. These mental model manifested verbally and used dermatosemiotic as framework to understanding the semiotic function of breast as complex semiotic text

that is interpreted differently by different readers or users .

Qualitative studies explore the first person perspective of the participants that is, disclosing their mental models, their thoughts, feelings about the matter. Mental models function as system boundary controlling the input and output. Thus, they function as an interface that control their semiotic interaction with outside and inside. I used semiotic interaction instead of symbolic one to give space for verbal (symbolic) and non-verbal (indexical) interaction. Milk is food of the baby which is received through breast that act as medium \vehicle. The breast function as medium touch, love, intimacy and erotic feeling .The conflict of these multiple function as a single medium \signifier, for multiple meanings \signified. This is what made choose the dermatosemiotics as introduced by Ali Tareq in his study of the problem of non-adherence among acne patients. He introduced dermatosemiotics as new version of IPA, that can provide the researcher with semiotic competency enabling them to diagnose the underlying mental models that function as a semiotic boundary \skin controlling what is touchable and tangible from what is not .Understanding mental model as semiotic skin is very helpful in facilitation the interview and semiotic interaction. In our study, I found that the shared mental model among adherent mothers to exclusive breastfeeding was breastfeeding as symbolic medium that fulfil their identity as a mother and fulfil the needs of the infants for touch and love and intimacy. The issue of milk is secondary for those women, as they report that most of the time the babies cries not for the milk but for the touch and feeling of being inside their mothers arm. Babies need the breast for not only feeding but to connect to their mother and feel inside them again. Infants still not accustomed to the extrauterine life. Breastfeeding is symbolically function as going back to the womb again .This create strong attachment between mother infant and ensure adherence and self-determination .

In this study I walked the less traveled paths in medicine and health care research, the phenomenological path, the complexity science path, the biosemiotic path. These less travelled paths enabled me to view the breastfeeding as a semiotic process that transform mothers and infants into complex adaptive system fulfilling the different needs of both of them. The problem with the traditional mental model used by healthcare system is its reductionism of health into the biological system and giving secondary status to the psychological, social and cultural context ^{17, 18} . The signs of being inside traditional biomechanical model is the focus on the function of the breast as biological medium for milk overlooking the semiotic tactile nature of the breasts that transform mothers and infants into complex adaptive system. I found that Adherent mothers to exclusive breastfeeding had been given the primacy for touch and motherhood as a mental model controlling their perception and action towards bottle feeding and other forms of feeding. Those who are inside biomedical

model about breastfeeding, which reduced breastfeeding reduced the breastfeeding to milk provision are more prone to non-adherence and cessation of breastfeeding shifting bottle feeding.

I found that, there are two mental models that can control the perception and attitude of mothers, society and healthcare professional towards breastfeeding. The first one is the linear causality model which is adopted by modern medicine. This linear analytical thinking model is responsible for failure of most interventions held by health care professionals to promote breastfeeding as an exclusive way of feeding at least for 6 months. The problem with this model is the medicalization \objectivation of the breastfeeding as a product. Women became a milk producing machine depriving the breastfeeding from its dialogical semiotic nature as a relational process which are lived experientially by all mothers through touch. The focus of modern medicine on the biological dimension of health and overlook other dimensions make health care professionals blind to the breastfeeding as tactile medium that connect the mother and infants emotionally more than just feeding medium that count them biologically. The threshold theme in my study is the mental model in use rather than the mental model espoused. The mental model in use is disclosed after achievement of rapport and empathetic listening making mothers aware of their lived experience while enacting breastfeeding. The eyes of most participants were filled with tears while talking about their feeling when they breastfed their infants .what is like to be in touch with their babies. I borrowed the language of Abraham Maslow to translate what happen while interviewing them .Mothers described their lived breastfeeding as peek experience, experience of emergence of new mode of being, new identity, feeling the meaning of motherhood as embodied experience rather just social role. Being mother is lived as relational process that triggered by the meeting with their infants when they breastfed them. The mental model shared by these adherent women is breastfeeding as tactile medium , as semiotic space that fulfil the needs of the infants for food and security , belonging , love and the presence of their infant in such close relation fulfil their need to be a mother .Thus ,what make breastfeeding in these women exclusive and continue more than 2 years in some cases , it follow the logic of win-win .Women win their identity as a mother and the child win their food and need for touch. Adopting phenomenological model give primacy for the intentionality of the lived experience as complex semiotic process which can be fulfilled tactually through the skin or symbolically through language. Motherhood can be fulfilled only tactually using the breast as medium for emergence of this relational dialogical identity using the language of Martin Buber and Mikhail Bakhtin ¹⁰⁰. The essential theme in this study is reframing breastfeeding from just physiological medium to dialogical medium that transform mothers and infants into complex adaptive system. This finding is consistent with the scaling up adopted by Lancet series in

developing new discourse about breastfeeding as complex adaptive system .This study is a response to the call of WHO for using system thinking to strengthening health care system and its related health problem. Women who give primacy for touch , relational nature of breastfeeding as semiotic process that communicate meanings ,values fulfilling the human as described by Abraham Maslow ²⁵. Self-determination is outcome of this tactile view of breastfeeding that make mothers know that nothing can replace them , nothing can give their babies symbolic milk in addition to the biological one ¹⁰¹. Infants growth and development are outcome of interaction of four systems: biological system which is embodied through milk, cognitive system which is embodied through touch and social system which is embodied through verbal and non-verbal communication and ecological system which is embodied through the breast as nest. In this study I found that what make mothers autopoietic and self-determined is their experience of breastfeeding as tactile medium, liminal space for emergence of love, motherhood and happiness. Breast function as a semiotic medium that communicate not just milk but values and meanings of belonging and connection. These findings were confirmed by Romana Kadzikowska-Wrzosek, she says as conclusion in her study:

“Autonomous motivation in breastfeeding mothers has a positive effect on their breastfeeding self-efficacy. The higher the breastfeeding self-efficacy, the more positive the breastfeeding mothers’ subjective experiences. High breastfeeding self-efficacy, which has a positive effect on the mother’s well-being, may also contribute to longer duration of breastfeeding”¹⁰¹.

CONCLUSIONS

The tipping point that transform mothers and infant into a complex adaptive system facilitating emergence of breastfeeding as an autopoietic, self-determined process is the tactile function of breast as semiotic boundary that communicate values, feeling and meanings embodied biologically as increase in oxytocin and phenomenologically as a motherhood and attachment. This finding confirms the recommendation of WHO Baby-Friendly Clinical Guidance released in 2018 by stating that birthing facilities should “facilitate immediate and uninterrupted skin-to-skin contact and support mothers to initiate breastfeeding as soon as possible after birth,”, adding that it “should be uninterrupted for at least 60 minutes.” This study will be successful if the health care system uses their both eyes, the left which see breastfeeding as opportunity for providing healthy nutritious milk and the right eye which view breastfeeding as symbolic interaction that transform the being of the mothers. The overarching theme in this study is a function of breastfeeding as tactile medium that communicate the feeling of motherhood, wholeness, and twining between the mothers and their infants facilitating emergence of exclusiveness as self-determination process. The effect of breastfeeding on the health outcome can’t be

reducible to the milk alone, touch has survival and thriving function. Kangaroo mother care (KMC) is one of the common intervention which can be used as evidence to confirm this claim⁷². The early initiation of the skin to skin contact trigger a shift on the being of women making them able to form emotional and social bond that can ensure adherence and exclusive breastfeeding^{55, 60, 61, 62}. Exclusive breastfeeding experience is a complex semiotic process that connect the mothers to infant semiotically an symbolically and not just physiologically. This new understanding is an essential background for scaling up program's that view health as complex adaptive system which is adopted by breastfeeding Lancet Series (2016).

I ended this study with the prophet Mohammed (A.S.) saying who summarize the theme of this research: *"A man came to the prophet (S) and complained about his heart being tough. The prophet (S) said: "would you like to soften your heart and get what you want? Have mercy on orphans, pass your hand on their heads and give them some of your food."*

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In this saying ,the prophet give the primacy for touch as communicative medium for kindness and mercy which is needed by the human being in general and orphans or infants in particular before the needs of food. Hence, The awareness of the primacy of touch\communication as basic survival need and not just a semiotic medium for feelings and values can be used as new frame of Maslow hierarchy of needs that gives the primacy for the physiological needs.

RECOMMENDATIONS

- I recommend using complexity science with its related tools like: system thinking, Agent-based models (ABM), game theory, social network theory to scale up breastfeeding promotion program which is adopted by 2016 Breastfeeding Lancet Series.
- I recommend using phenomenology as a mental model to define the body, illness, health in addition other models used by healthcare professionals. Phenomenological model gives the primacy for lifeworld the world of first-hand experience, world of touch\heart, feelings, closeness, interdependence, complexity, chaos, uncertainty.
- I recommend using ethnography to study the social structures that can facilitate or impeded the emergence of exclusive breastfeeding.

Disclosure Statement

The authors of this paper have no personal or institutional conflict of interest.

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