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# Modelling learning for a better safety culture within an organization using a virtual safety coach: Reducing the risk of postpartum depression via improved communication with parents



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# ABSTRACT

This paper describes an extension of a safety culture within hospital organizations providing more transparency and acknowledgement of all actors, and in particular the parents. It contributes a model architecture to support a hospital to develop such an extended safety culture. It is illustrated for prevention of postpartum depression. Postpartum depression is a commonly known consequence of childbirth for both mothers and fathers. In this research, we computationally analyze the risk factors and lack of support received by fathers. Therefore, we use shared mental models to model the effects of poor and additional communication by healthcare practitioners to mitigate the development of postpartum depression in both the mother and the father. Both individual mental models and shared mental models are considered in the design of the computational model. The paper illustrates the benefits of simple support in terms of communication during childbirth, which has lasting effects, even outside the hospital. For the impact of additional communication, a Virtual Safety Coach is designed that intervenes when necessary to provide support, i.e., when a health care practitioner doesn't. Moreover, organizational learning is also modelled to improve the mental models of both the Safety Coach and the Health Care Practitioner.

# 1. Introduction

Learning is an integral part of organizations. Therefore, organizational learning (Kim, 1997), has been coined as a key concept, as it facilitates further development, both within individuals, and as a result, within teams and organizations. This can lead to better governance and an adequate safety culture, also known as 'safety culture' or 'just culture'. The term refers to a culture within an organization that promotes open communication, transparency, and trust amongst the practitioners in any field (Solomon, 2016). It is a tool to facilitate organizational learning.

In a healthcare organization, healthcare practitioners from multiple disciplines form healthcare teams, who strive to ensure the safety of patients. These teams coordinate and communicate throughout a certain medical procedure in a very cohesive manner to avoid all the risks that can be associated with healthcare. Moreover, these institutions maintain stability by following the protocols related to their medical procedures, and therefore, often these protocols are evaluated and modified to ensure patient safety (Crossan et al., 1999). For instance, childbirth is a sensitive and a daily occurring natural phenomenon in hospitals, that follows a certain protocol or procedure. In a protocol like this, there are steps in place, for before, during and after, that healthcare practitioners must follow to ensure a safe and healthy delivery of the child. The main aim is to keep the mother and the baby safe during the whole process of delivery.

Safety culture encompasses realizing omissions and mistakes and not being scrutinized for the mistake or omission but instead learning from it. Practitioner-patient communication is a valuable step that can result in improved therapeutic outcomes (Hassan, 2018). However, most of the time, delivery protocols are only in place for processes and changes or deviations in processes that may occur for the baby or the mother (Taal, 2022). They fail to consider the possible adverse effects that may happen to the other-half or the family of a neonate. Bedside manners are within the curriculum of medical studies; however, the importance of adequate

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patient communication is often underestimated and, often considered to be a less valued step, and sometimes even a forgotten step, within the protocol. A lack of communication with both the mother and partner can result in feelings of isolation. Moreover, the different situational roles of parents and health care practitioners (HCPs) do not allow for open communication. This barrier is a factor that may develop mental health problems in parents, such as postpartum depression (PPD) (Goodman, 2004). While maternal PPD is awarded attention, the same cannot be said for paternal postpartum depression (Goodman, 2004). The feeling of isolation often contributes to paternal postpartum depression (PPPD), since fathers are not the active actors during the childbirth process, and little attention is awarded to them during the process. Paternal PPD is accompanied by adverse effects affecting both the mother and the child. This paper discusses methods that could facilitate better support for a father with the aim of decreasing the frequency of fathers experiencing mental health issues (Goodman, 2004, 2008).

In this paper, we use computational models to discuss a) how a deviation in the childbirth process may lead to poor communication towards the parent(s). We also present b) how a virtual safety coach can facilitate the healthcare practitioners for effective communication with parents in the context of childbirth process. Lastly, we address c) how organizational learning can play a role in improving the mental models underlying communication. A virtual AI Coach can also help health practitioners to keep the parents intact (i.e., psychologically and socially) during the whole process. The designed models encompass protocols with common knowledge for all actors involved, as well as their own individual knowledge. The research focuses on reducing paternal postpartum depression and illustrates the positive influence this has on maternal postpartum depression. So, we present ways to encourage open and adequate communication both from the father's side and the healthcare practitioner's side. The aim is to expand the definition of safety culture, to involve not only the medical practitioners but also the patients and their families through the means of improved communication. In return, this implementation depicts the benefits of open communication and its subsequent effect of decreasing the risk of both the mother and father developing PPD (Goodman, 2004). For more detailed references see Section 2.

# 2. Background literature

In this section, we present the background literature of our work. We will discuss the risk factors for maternal postpartum depression (Mayers et al., 2020), together with their consequences (Rao et al., 2020). Then we explain risk factors for paternal postpartum depression along with possible outcomes (Goodman, 2008). We will also discuss how postpartum depression can be prevented (Dennis, 2004; Smythe et al., 2022). Specifically, how paternal postpartum depression can be prevented, which in return has significant influence on reducing maternal postpartum depression. Moreover, we will discuss how computational causal modelling can play its role preventing the related risks.

# 2.1. Maternal postpartum depression and the related risk factors

The ICD-10 states that "in typical mild, moderate, or severe depressive episodes, the patient suffers from lowering of mood, reduction of energy, and decrease in activity. Capacity for enjoyment, interest, and concentration is reduced, and marked tiredness after even minimum effort is common" (World Health Organization(WHO), 1993). Postpartum depression refers to "mild mental and behavioural disorders associated with the puerperium" (World Health Organization(WHO), 1993). In industrialized countries 10 %-15 % of women experience major depressive episodes after giving birth (Maternal mental health and child health and development in resource-constrained settings, 2009, January 1). This statistic encompasses women with prior and without prior mental health issues. The phenomena of developing depression after childbirth, known as maternal postpartum depression

(MPPD), is among the most common mental health consequences. Determining causes, possible interventions and creating support systems for new mothers suffering from PPD is at the forefront of postnatal care research (Garthus-Niegel et al., 2022; Mayers et al., 2020; Rao et al., 2020), as it may prevail for extended periods (Rao et al., 2020; Smythe et al., 2022).

Reasons for postpartum depression include obstetric factors, psychological factors, biological factors, social factors and lifestyle (Abenova et al., 2022; Javaid et al., 2022). Women who are nulliparous generally benefit from technically oriented support such as help with breastfeeding. On the other hand, multiparous women require more mental support, as they are at a higher risk of developing PPD, due to the additional stress of having another child at home (Dunkel Schetter et al., 2016). Another factor is the risk of the birth, especially when doctors must deviate from the original birth plan. A deviation from normal protocol results in a higher risk of the mother developing PPD. Similarly, deviating (having a caesarean section) from the mothers' desires (having a natural birth), has the same effect (Ghaedrahmati et al., 2017). The mode of delivery also influences the risk of developing PPD, with a natural birth being the safest option (Silverman et al., 2017). In addition, although it is a highly debated topic, the use of epidurals has been identified to decrease the chances of mothers developing PPD (Ghaedrahmati et al., 2017). Amongst all other factors, age also plays a role. Women who are 35 years or older are at a higher risk of developing PPD. The lowest risk is for women between the ages of 25 and 29 (Silverman et al., 2017). The age factor pertains to the fact, that the riskiness of the birth is higher for the prior (Cavazos-Rehg et al., 2015). Lastly, a motherto-be is 4-18 times more likely to develop PPD if their child is born underweight (<1500 g) (Ghaedrahmati et al., 2017).

In addition to the factors mentioned above, social factors must be acknowledged to decrease the risk of a mother developing PPD. The social network around the woman is the most important aspect regarding support. "Newly expecting mothers perceive their partner as their main support system" (Mayers et al., 2020; Smythe et al., 2022). Their partners often see signs of change and act upon them, to ensure the woman receives the necessary mental health support.

# 2.2. Consequences beyond the mother of postpartum depression

Mothers suffering from postpartum depression receive a great amount of attention, as the negative correlation between a mother's mental health and a child's development is widely known (Cerezo et al., 2008; Goodman, 2008). However, the spillover effect onto their partners is often not addressed. At the same time, father's support has been proven to benefit a mother's mental health (Goodman, 2004). "Maternal depression was identified as the strongest predictor of paternal depression during the postpartum period" (Goodman, 2004). 25 % of women who experience PPD have a partner who is also experiencing PPD (Goodman, 2008). Paternal postpartum depression is not a commonly known consequences of childbirth, as the attention, support and communication are directed towards the mother. This inequality in mental health services provided to mothers and fathers, results in fathers reporting feelings of isolation following childbirth. Most notably, this is prevalent following a traumatic birth, or simply a deviation from the original birth plan. This isolation creates insecurity and confusion for the fathers regarding their role (Mayers et al., 2020).

# 2.2.1. Paternal postpartum depression

The responsibility of a child can be overwhelming and intimidating. Moreover, childbirth is an intense experience for both mother and father. However, while mothers are fully involved and sufficiently supported, fathers often don't get the same treatment (Goodman, 2004). The lack of paternal support received, increases the difficulty, both technically and mentally, of having a child. This results in a high chance of fathers developing postpartum depression (Goodman, 2004, 2008).

While most partners feel as though the mother should be receiving

most of the attention, the extreme imbalance between the information available to them and information available to mothers is not justified (Mayers et al., 2020). Fathers feel as though they should be given or offered more support and information than what is currently the norm. Additionally, the quality of mental health support has been criticized. "Fathers require better recognition of their mental health needs from healthcare professionals" (Mayers et al., 2020).

Societal stigma often results in the fathers not seeking for help, as they are meant to be the providers of the family and don't allow themselves to suffer mentally. Moreover, as fathers are not briefed on PPPD, they often don't see the signs and only accept the truth when it's too late for early intervention. Similarly, women may see a change in their partner. However, they do not have the priming of it potentially being PPD and therefore ignore the signs (Abenova et al., 2022).

The chances of paternal postpartum depression increase with unexpected childbirth, as a change of procedure while in the delivery room can be traumatizing for the father. The fear that develops in their minds, when there is no proper communication between healthcare personnel and the father in the delivery room causes the fathers to think of the worst possible outcomes (Pedersen et al., 2021). A lack of support and communication from healthcare practitioners directly to the partners, results in a sensation of helplessness, isolation, and confusion regarding the partners mental health issues (Melrose, 2010). Similarly to maternal PPD, paternal postpartum depression not only affects the father but also the mother and the child's development (Goodman, 2004, 2008; Rohde et al., 2005).

#### 2.2.2. Consequences of paternal postpartum depression

Positive parent-infant interaction is the key to ensuring children's good psychological, cognitive and language development. Partners of women who suffer from PPD experience higher parenting stress, which results in less optimal father-infant interaction (Goodman, 2008). In other words, parent-infant interaction is highly influenced by the mental well-being of the parents. Similarly, another study indicated that PPPD might have important implications on the family's mental health and wellbeing. A high correlation was found between the depression of one parent and the other, producing significantly adverse effects on the other parent and child (Goodman, 2004). Moreover, a study indicated that children of fathers with PPPD reported increased emotional and psychological issues (Rohde et al., 2005).

Depression is also sometimes termed as 'a preventable killer', because inadequate handling of such psychiatric disorders may lead to the death of a partner, making the situation more complex (Biebel et al., 2018; Kenyon, 2015; Mayers et al., 2020). To ensure prosperity for a child's future life, hospitals should aim to identify signs of possible development of PPD in mothers and fathers. Moreover, they should try to restore mental health as soon as possible (Melrose, 2010). Tackling perinatal mental health support can reap long-term benefits for both the parents and the child (Mayers et al., 2020).

# 2.3. What can be done more to prevent paternal postpartum depression

A study by Mayers et al. (Mayers et al., 2020) quoted fathers on their experiences and desires after childbirth.

"I read the information my wife was given".

"It didn't cover anything about the father and I felt lost".

"Leaflets on what to look out for, as you can't always remember what you are told in the immediate aftermath".

"Some Mental Health support, as well as social worker support and referral to a therapist".

"[I] had not given birth so had no cause for sympathy. A leaflet for my wife and a page for the fathers to read which wasn't enough" (Mayers et al., 2020).

Partners of new mothers have expressed the need to a better understanding on how they can support the new mothers, as well as themselves. Specifically, clear communication and information regarding treatment and medication, to help the women, as well as to ease their own concerns. Currently, there is not enough support or information provided, and in the cases where support is given, the quality on average, is very low (Mayers et al., 2020). Due to the social stigma of a man's role in society, as well as the pressure of having to be a protector and a provider, fathers have expressed reservations about joining groups for support (Darwin et al., 2017). Darwin et al. concluded that fathers are reluctant and unable to seek help, as they "question the legitimacy of their experiences" and believe that the woman should have priority, especially when they perceive the facilities to help with mental health are under-resourced (Darwin et al., 2017). A further issue raised, was that verbally communicated information was often forgotten, especially when this information was relayed during a stressful time (Mayers et al., 2020).

Fathers have expressed their desire to receive information regarding postnatal mental illness (Pedersen et al., 2021), having someone to talk to, and direct healthcare service support that is specifically targeted towards them. The provided support currently does not seem enough, specifically in deviations that may happen during the process (Taal, 2022), which in return diminishes their ability to support themselves and the mother properly. A simple solution given by a father could be "any offer of help and support" (Mayers et al., 2020). The opportunity to have someone to talk to, as well as simply being acknowledged, was regarded as being very valuable. A referral to a therapist or social worker was suggested (Mayers et al., 2020).

Moreover, a standard agreed-upon method of receiving information for fathers would be in the form of readily available leaflets or various other types of written materials, as they would be easily accessible at any point in time. Emphasis was assigned to the helpfulness of having written material depicting other men's experience. This made them "realize you're not in the boat by yourself" (Darwin et al., 2017). The areas that are generally lacking within the support services are informational support and aftercare. "Early interventions to help fathers cope with stress may be needed to reduce the risk of future deterioration of emotional wellbeing" (Mayers et al., 2020; Pedersen et al., 2021).

# 3. Conceptual analysis of underlying processes and means to model them

This section presents the preliminary analysis of the underlying process that will be considered for modelling the communication and learning behavior for the safety coach, health practitioner and parents (addressed in Section 4). Firstly (in Section 3.1), we explain safety culture in the context of a parent seeking help and support during the procedure. Secondly (in Section 3.2), we explain how organizational learning can play a role in encouraging communication during the process of childbirth. Lastly, we explain the role of the mental models in Section 3.3, along with the cognitive architecture used to model them and the learning of them.

# 3.1. Safety culture

A good safety culture facilitates learning. Safety culture encompasses realizing omissions and mistakes, realizing that one may not fully be at fault, admitting to the errors and not being scrutinized for the error, but instead learning from it. Applying a safety culture creates an open environment for further development. It decreases the frequency of errors since individuals are willing to admit to them, instead of trying to cover up which may worsen the situation (Darwin et al., 2017). Facilities, which would benefit greatly from integrating a just safety culture, are hospitals. "A blame-free, nonpunitive culture encourages clinicians to report errors and truly learn from their mistakes. It also supports organizations in efforts to better understand their errors and make improvements" (Beyea, 2004). The basis of this is founded on open communication with the goal of moving away from extreme punishment or a blameless culture and instead moving towards a just culture (Boysen, 2013). The scope of this paper doesn't refer to just safety culture in the classical sense, which encompasses a medical professional speaking up to avoid immediate medical mistakes. It addresses just safety culture by the father's willingness to speak up and ask for support. The awareness that all actors inside the delivery room, including medical professionals and parents, are complex beings with desires and that they possess an understanding of what is needed to ensure overall success and health, is essential (Smythe et al., 2022). In addition, the understanding and acknowledgement that the actions currently taken may not be sufficient in some cases holds similar importance. Although the action of asking for support communication itself is not an active preventative measure, the resulting support serves as a tool to avoid possible longterm mental-health consequences (Kenyon, 2015; Mayers et al., 2020). This perspective aims to bridge the gap between mental and physical health and emotional health, as they are not only independent of each other, but also dependent on each other (Pinto-Foltz & Logsdon, 2008). By expanding the view of the involved actors, it allows for a more wellrounded approach with various points of view and an ever-increasing just safety culture (Darwin et al., 2017; Hassan, 2018; Ratnapalan & Ulervk, 2014).

This approach to safety culture has the ability to extend the range of the benefits from short-term to long-term. Communication is not strictly a medical step; where if a mistake occurs, it expresses itself in direct consequences. However, it should be considered a valuable medical step, as it entails a simple skill that all individuals know, and can prevent consequences that aren't immediate, but can be visible in the long term (Hassan, 2018). The goal is to encourage the implementation of a wellrounded treatment where the effects don't stop when one leaves the hospital.

# 3.2. Organizational learning

Crossan et al. (1999) define organizational learning as:

"a dynamic process. Not only does learning occur over time and across levels, but it also creates a tension between assimilating new learning (feed forward) and exploiting or using what has already been learned (feedback). Through feed-forward processes, new ideas and actions flow from the individual to the group to the organization levels. At the same time, what has already been learned feeds back from the organization to group and individual levels, affecting how people act and think" (Crossan et al., 1999).

"Feed forward relates to exploration. It is the transference of learning from individuals and groups through to the learning that becomes embedded-or institutionalized-in the form of systems, structures, strategies, and procedures (Hedberg, 1981; Shrivastava, 1983). Feedback relates to exploitation and to the way in which institutionalized learning affects individuals and groups" (Crossan et al., 1999).

The four I's of organizational learning are intuiting, interpreting, integrating, and institutionalizing. The first two relate to an individual, the second and third to a team or group and the third and last to an organization (Crossan et al., 1999). These overlaps are links between the levels. For organization learning to occur, the understanding that an "organization operates in an open system, rather than having a solely internal focus" (Crossan et al., 1999) is crucial. In other words, there is a transfer of knowledge between individuals, groups and organizations (Kim, 1997). According to Peter Senge's theory successful learning has the capacity to change and manage change, where an organization can adopt system thinking, shared mental models and shared vision can help learn in teams (Ratnapalan & Uleryk, 2014).

# 3.3. Mental models

Mental models are at the base of an individual's actions. Kim

describes them as follows:

"Mental models represent a person's view of the world, including explicit and implicit understandings. Mental models provide the context in which to view and interpret new material, and they determine how stored information is relevant to a given situation" (Kim, 1997).

Interesting to note is the similarity between the two I's for individuals mentioned earlier and Kim's definition of mental models. The definition encompasses both 'intuiting' ('a person's view of the world, including explicit and implicit understandings') and 'interpreting' ('interpret new material'). Mental models are useful for individuals to create internal simulations based on certain circumstances. Moreover, new mental models or additions or revisions to mental models can be learned. This is encompassed by Piaget, who assigns importance to the marriage of accommodation (adapting ones individual internal concepts based on experiences) and assimilation (integrating ones experiences into ones individual internal concepts) as the keys to learning (Kim, 1997; Piaget, 1970).

Shared mental models are various mental models that ideally align themselves in a manner that they become shared knowledge. Therefore, their representation may not only rely on differential knowledge of a member, but they may also represent an overlap or convergence among their mental models in relation to a task or procedure. As shared mental models are related to a mutual goal, it relies mainly on understanding requirements and steps taken during a procedure. They can be equated to the third I, 'integrating'. Integrating refers to a shared understanding and mutual adjustment, creating interactive systems (Crossan et al., 1999). To facilitate integration, interpretation must be done by the means of communication (Bouma, Canbaloğlu, Treur, & Wiewiora, 2023).

# 3.4. Cognitive architecture used for shared mental models

Network-Oriented Modelling is a technique that can be used to model interconnected and interactive causal processes that are temporal by nature (Treur, 2016). Given the direct relation between dynamics and causal relations, as highlighted in (Treur, 2016), this classical approach is extended to contain the notion of dynamics in a network structure. These notions of causality and dynamics have been incorporated and are part of a more refined structure and semantics of the considered networks. More specifically, the nodes in a network are interpreted here as states (or state variables) that vary over time, and the connections are interpreted as causal relations that define how each state can affect other states over time. To acknowledge this perspective of dynamics and causality on networks, this type of network has been called a temporalcausal network (Treur, 2016).

Temporal-causal networks are the foundation of dynamic Network-Oriented Modelling. While the popular approach of causal modelling comes with limitations, the addition of dynamic features provides a more detailed and truthful representation of the real-world (Treur, 2016). This dynamic perspective is based on a continuous time dimension, represented by real numbers. The temporal dimension enables modelling by cyclic causal networks as well, and also timing of causal effects can be modelled in detail. Due to this, causal reasoning and simulation is possible for networks that inherently contain cycles, such as networks modeling mental or brain states, or networks describing social interaction. (Treur, 2016).

The research conducted for this paper is performed addressing mental processes using internal mental models, which are modeled in a network-oriented manner (see (Treur, 2016, 2020)). It encompasses a social structure, depicting how people interact amongst themselves, as well as network structures that depict an individual's mental processes, in this case also including internal mental models, (Treur & Van Ments, 2022). These models can also be used to reflect adaptive organizational behavior (Canbaloğlu et al., 2022). In this technique, a network can be

Combination Functions used in the Self-Modelling Network Model.

	Notation	Formula	Parameters
Advanced logistic sum	$\mathbf{alogistic}_{\sigma,\tau}(V_1, \cdots, V_k)$	$\left[\frac{1}{1+\mathrm{e}^{-\sigma(V_1+\cdots+V_k-\tau)}}-\frac{1}{1+\mathrm{e}^{\sigma\tau}}\right]\left(1+e^{-\sigma\tau}\right)$	Steepness $\sigma$ Excitability threshold $\tau$
Step once	$steponce_{\alpha,\beta}(V)$	1 if $\alpha \le t \le \beta$ for time <i>t</i> , else 0	Start time $\alpha$ End time $\beta$
Monitor	$\operatorname{monitor}_{\operatorname{\tau}}(V_1,V_2)$	1 if $V_1 - V_2 \ge \tau$ , else 0	Activation threshold $\tau$



Fig. 1. Connectivity of the Base Model of the Childbirth Process.

represented by a labelled graph containing states, also known as nodes, where each state X is connected to another state Y and where X has a causal impact on Y, at a certain time, with some strength and speed. A, a temporal-causal network is characterized by (Treur, 2016):

• Connectivity characteristics:

Connections from a state *X* to a state *Y* and their weights  $\omega_{X,Y}$ .

• Aggregation characteristics:

For any state Y, some combination function  $\mathbf{c}_{Y}(\cdots)$  defines the aggregation that is applied to the single causal impacts  $\omega_{X,Y}X(t)$  on Y from its incoming connections from states X.

• Timing characteristics:

Each state *Y* has a speed factor  $\eta_Y$  defining how fast it changes for a given causal impact.

The related difference equation (1) incorporates these characteristics in a standard numerical format (Treur, 2016), i.e.:

$$Y(t + \Delta t) = Y(t) + \mathbf{\eta}_{Y} \left[ \mathbf{c}_{Y} \left( \mathbf{\omega}_{X_{1},Y} X_{1}(t), \cdots, \mathbf{\omega}_{X_{k},Y} X_{k}(t) \right) - Y(t) \right] \Delta t$$
(1)

Here the  $X_i$  are the states from which state Y gets incoming connections. Numerous combination functions are available to address the issue of aggregating multiple impacts (Treur, 2016). Those which were used for this research are shown in Table 1.

The modelling of adaptive networks is based on network reification (or self-modeling network), which entails extending the base model by reification states, also referred to as self-model states. Reification is defined as "representing something abstract as a material or concrete thing, or making something abstract more concrete or real" (Treur, 2020). The self-model states are part of a higher order adaptation and are visually placed on a higher plane than the base level. Similar to how the base level can be adaptive, the first reification level, also known as first-order self-model, can also be adaptive by nature. Therefore, the higher-order adaptive levels are not limited to one, as the construction can be iterated indefinitely. Network reification for a temporal-causal network means that for the adaptive network structure characteristics  $\omega_{X,Y}$ ,  $\mathbf{c}_Y(\dots)$ ,  $\eta_Y$  for each state *Y* of the base network, additional network states  $\mathbf{W}_{X,Y}$ ,  $\mathbf{C}_Y$ ,  $\mathbf{H}_Y$  (called reification states) are introduced respectively (Treur, 2020). Different simulating environments are used to simulate the (shared) mental models in Matlab and Python. In section 6, we explain how these characteristics can be used to simulate a model in Python.

# 4. The designed network model

The model discussed in this paper focuses on childbirth at a hospital, where the father is constantly present in the delivery room, even in circumstances where a deviation from a standard protocol may happen (Taal, 2022). It mainly encompasses the communication process starting shortly before childbirth and ending once the parents leave the hospital. The majority of the states in the model reflect communication actions, specifically geared towards the father. The communication process may (or may not) take place during and after childbirth, even in circumstances where a deviation can occur.

The research described in this paper extends to two levels of adaptation (two self-modelling levels) on top of the base level. Therefore, in Section 4.1, we present the base model, which shows the model. In section 4.2, we add the adaption level through self-modelling network and the role of a healthcare practitioner and a virtual safety coach (AIC). Lastly, in Section 4.3., we present how organization learning can influence the learning of the safety coach. Please note that the model presented in the following sections are mainly related to the communication between the healthcare practitioner (HCP) and the father of a neonate during the process of childbirth.

# 4.1. Base level of the adaptive network model

The base level, depicted in Fig. 1 (yellow parallelogram), contains

Base Level States (including HCP Mental Model).

State Number	State Name	Explanation	Level
X <sub>1</sub>	type_mom	Pre-Birth: Determining whether the mother is nulliparous (first child) or multiparous (already has 1+ child)	
X <sub>2</sub>	artificiality_birth	Pre-Birth: Determining the naturality of the birth: natural birth or caesarean section	1
X <sub>3</sub>	epidural_used	Pre-Birth: Determining if an epidural will be administered	
X.4	deliv_baby	Intra-Birth: Delivery of the baby; the woman is in labour	1
X <sub>5</sub>	baby_born	Post-Birth: The baby is born	
X <sub>6</sub>	MPPD	Post-Birth: The risk of maternal postpartum depression	1
X <sub>7</sub>	PPPD	Post-Birth: The risk of paternal postpartum depression	
X <sub>8</sub>	imp_kid_devel	Post-Birth: The risk of impeding child flourishing/development	
Х <sub>9</sub>	pre_birth_info	Pre-Birth: Information given to parents	
X <sub>10</sub>	com_sup_hcp	Intra-Brith: Communication from HCP to parents	
X <sub>11</sub>	fat_ask_sup_com	Intra-Birth: Father asks HCP for support communication	
X <sub>12</sub>	fat_rec_sup_com	Intra-Birth: Father receives support communication from HCP	1
X <sub>13</sub>	post_info_com_par	Post-Birth: Information given to parents	
X <sub>14</sub>	refer_therapist	Post-Birth: Referall by HCP of parent(s) to a therapist	Pasa Loval
X <sub>15</sub>	mental_sup	Post-Birth: Recieve additional mental support	Dase Level
X <sub>16</sub>	acknowl_fat	Acknowledgement of the father as an actor in childbirth by HCP	
X <sub>17</sub>	age	Age of mother: whether she is between the ages of 25-29 or not	
X <sub>18</sub>	riskiness	Riskiness of giving birth for the mother	
X <sub>19</sub>	dilation_mom	Dilation of the mother	
X <sub>20</sub>	premature_birth	Premature birth	
X <sub>21</sub>	type_com	Type of commuication received/used: verbal or written	
X <sub>22</sub>	retention	Ability to retain information received	
X <sub>23</sub>	engaged	Level of active engagement	
X <sub>24</sub>	stress	Level of stress	
X <sub>25</sub>	birth_dev	Deviation from original birth plan	
X <sub>26</sub>	fear_level	Level of fear	
X <sub>27</sub>	desire_sup	Desire for support	
X <sub>28</sub>	ask_sup	Willingness to ask for support	
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	Intra-Birth: Detecting a birth deviation	
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	Intra-Birth: Determining the risk of a given birth deviation	
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	Intra- & Post-Birth: Encouraging the mother positively	
X <sub>32</sub>	calm_dad <sub>HCP</sub>	Intra- & Post-Birth: Calming the father	
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	Post-Birth: Detecting irregular birth weight of the child	
X <sub>34</sub>	det_underw <sub>HCP</sub>	Post-Birth: Determining the child as underweight	Raco Loval - HCR Montal Model
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	Post-Birth: Referring the mother to a therapist	base Level - ficr Wental Woder
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	Post-Birth: Teaching the father how to support the mother (techincally and mentally)	
X <sub>37</sub>	baby_born <sub>HCP</sub>	Post-Birth: The baby is born	
X <sub>38</sub>	type_com <sub>HCP</sub>	Type of commulcation used: verbal or written	
X <sub>39</sub>	type_mom <sub>HCP</sub>	Pre-Birth: Determining whether the mother is nulliparous (first child) or multiparous (already has 1+ child)	
X40	pre_birth_info <sub>HCP</sub>	Pre-Birth: Giving information to parents	



Fig. 2. Connectivity of First-Order Adaptive Network Model Case (a) irst-Order Self-Model States (or First Reification Level States).

Additional Base Level and First-Order Self-Model States (or First Reification Level States).

State Number	State Name	Explanation	Level
X <sub>41</sub>	birth dev detair	Intra-Birth: Detecting a birth deviation	
X <sub>42</sub>	det_risk_level <sub>AIC</sub>	Intra-Birth: Determining the risk of a given birth deviation	
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	Intra- & Post-Birth: Encouraging the mother positively	
X <sub>44</sub>	calm_dad <sub>AIC</sub>	Intra- & Post-Birth: Calming the father	
X <sub>45</sub>	irr_birth_weight <sub>AIC</sub>	Post-Birth: Detecting irregular birth weight of the child	
X <sub>46</sub>	det_underw <sub>AIC</sub>	Post-Birth: Determining the child as underweight	Deep Level AIC Mantel Martel
X <sub>47</sub>	refer_mom_ther <sub>AIC</sub>	Post-Birth: Referring the mother to a therapist	Base Level - AIC Mental Model
X <sub>48</sub>	teach_dad_sup_mom <sub>AIC</sub>	Post-Birth: Teaching the father how to support the mother (techincally and mentally)	
X <sub>49</sub>	baby_born <sub>AIC</sub>	Post-Birth: The baby is born	
X <sub>50</sub>	type_com <sub>AIC</sub>	Type of commuication used: verbal or written	
X <sub>51</sub>	type_mom <sub>AIC</sub>	Pre-Birth: Determining whether the mother is nulliparous (first child) or multiparous (already has 1+ child)	
X <sub>52</sub>	pre_birth_info <sub>AIC</sub>	Pre-Birth: Giving information to parents	
X <sub>61</sub>	Wbirth_dev_det_AIC, det_risk_level_AIC	Reified representation state for connection weight $\omega_{\text{birth\_dev\_det\_AIC, det\_risk\_level\_AIC}}$	
X <sub>62</sub>	W_det_risk_level_AIC, encourage_mom_AIC	Reified representation state for connection weight $\omega_{det_risk\_level\_AIC, encourage\_mom\_AIC}$	
X <sub>63</sub>	W_det_risk_level_AIC, calm_dad_AIC	Reified representation state for connection weight $\omega_{det_risk\_level\_AIC, calm\_dad\_AIC}$	
X <sub>64</sub>	Wirr_birth_weight_AIC, det_underw_AIC	Reified representation state for connection weight $\omega_{irr\_birth\_weight\_AIC, det\_underw\_AIC}$	
X <sub>65</sub>	W_det_underw_AIC, refer_mom_ther_AIC	Reified representation state for connection weight $\omega_{det\_underw\_AIC, refer\_mom\_ther\_AIC}$	
X <sub>66</sub>	W_det_underw_AIC, teach_dad_sup_mom_AIC	Reified representation state for connection weight $\omega_{det\_underw\_AIC, teach\_dad\_sup\_mom\_AIC}$	
X <sub>67</sub>	Wbaby_born_AIC, type_com_AIC	Reified representation state for connection weight $\omega_{\text{baby\_born\_AIC, type\_com\_AIC}}$	
X <sub>68</sub>	W <sub>type_mom_AIC</sub> , pre_birth_info_AIC	Reified representation state for connection weight $\omega_{\text{type_mom_AIC, pre_birth_info_AIC}}$	First reification level
X <sub>69</sub>	Hencourage_mom_AIC	Reified representation state for speed factor $\eta_{ ext{encourage_mom_AIC}}$	
X <sub>70</sub>	H <sub>calm_dad_AIC</sub>	Reified representation state for speed factor $\eta_{calm\_dad\_AIC}$	
X <sub>71</sub>	Hrefer_mom_ther_AIC	Reified representation state for speed factor $\eta_{ m refer\_mom\_ther\_AIC}$	
X <sub>72</sub>	H <sub>teach_dad_sup_mom_AIC</sub>	Reified representation state for speed factor $\eta_{ ext{teach\_dad\_sup\_mom\_AIC}}$	
X <sub>73</sub>	H <sub>type_com_AIC</sub>	Reified representation state for speed factor $\eta_{ ext{type_com_AIC}}$	
X <sub>74</sub>	Hpre_birth_info_AIC	Reified representation state for speed factor $\eta_{ extsf{pre_birth_info_AIC}}$	
X <sub>75</sub>	con_act_AIC	Context state for determining activation of the AIC	



Fig. 3. Connectivity of First-Order Adaptive Network Model Case (b).

the world states and the mental model of the healthcare practitioner (HCP). The world states in the base level of the model can be one of five types: process states (yellow), context states (orange), emotion states (red), paternal states (light orange), or communication action states (dark yellow).

The process states define both the baby being delivered and then subsequently, for example hours or days, after birth, as well as the risk of developing maternal postpartum depression, the risk of developing paternal postpartum depression and the risk of impending child development. The context states influence the process states, the emotion states and in some circumstances other context states. The emotion states represent the emotions of the actors that occur during childbirth which influence frequent communication. The paternal states indicate the process through which the father may go before reaching out for help. Lastly, the central part, the communication action states, depict the interaction between HCP and parents, specifically the father, throughout the childbirth process. The states were created based on the findings explained in Section 2 of this paper. The connectivity of the base model can be seen in Fig. 1, while the detailed description of the states of the base level is enlisted in Table 2.

Case (c) First-Order Self-Model States (or First Reification Level States).

State Number	State Name	Explanation	Level
X <sub>53</sub>	Wbirth dev det HCP, det risk level HCP	Reified representation state for connection weight $\boldsymbol{\omega}_{\text{birth dev det HCP, det risk level HCP}}$	
X <sub>54</sub>	Wdet risk level HCP, encourage mom HCP	Reified representation state for connection weight $\omega_{det risk}$ level HCP, encourage mom HCP	
X <sub>55</sub>	W det risk level HCP, calm dad HCP	Reified representation state for connection weight $\boldsymbol{\omega}_{det \ risk \ level \ HCP, \ calm \ dad \ HCP}$	
X <sub>56</sub>	Wirr birth weight HCP, det underw HCP	Reified representation state for connection weight $\boldsymbol{\omega}_{irr}$ birth weight HCP, det underw HCP	
X <sub>57</sub>	Wdet underw HCP, refer mom ther HCP	Reified representation state for connection weight $\omega_{det underw HCP, refer mom ther HCP}$	
X <sub>58</sub>	W_det_underw_HCP, teach_dad_sup_mom_HCP	Reified representation state for connection weight $\mathbf{\omega}_{det\_underw\_HCP, teach\_dad\_sup\_mom\_HCP}$	
X <sub>59</sub>	Wbaby_born_HCP, type_com_HCP	Reified representation state for connection weight $\boldsymbol{\omega}_{ ext{baby_born_HCP, type_com_HCP}}$	
X <sub>60</sub>	Wtype_mom_HCP, pre_birth_info_HCP	Reified representation state for connection weight $m{\omega}_{ ext{type_mom_HCP, pre_birth_info_HCP}}$	
X <sub>61</sub>	Wbirth_dev_det_AIC, det_risk_level_AIC	Reified representation state for connection weight $\omega_{\text{birth\_dev\_det\_AIC, det\_risk\_level\_AIC}}$	
X <sub>62</sub>	Wdet_risk_level_AIC, encourage_mom_AIC	Reified representation state for connection weight $\omega_{det_risk\_level\_AIC, encourage\_mom\_AIC}$	
X <sub>63</sub>	Wdet_risk_level_AIC, calm_dad_AIC	Reified representation state for connection weight $\omega_{det\_risk\_level\_AIC, calm\_dad\_AIC}$	
X <sub>64</sub>	Wirr_birth_weight_AIC, det_underw_AIC	Reified representation state for connection weight $\omega_{irr\_birth\_weight\_AIC, det\_underw\_AIC}$	
X <sub>65</sub>	W_det_underw_AIC, refer_mom_ther_AIC	Reified representation state for connection weight $\omega_{\text{det_underw_AIC, refer_mom_ther_AIC}}$	
X <sub>66</sub>	W_det_underw_AIC, teach_dad_sup_mom_AIC	Reified representation state for connection weight $\omega_{\text{det\_underw\_AIC, teach\_dad\_sup\_mom\_AIC}}$	
X <sub>67</sub>	Wbaby_born_AIC, type_com_AIC	Reified representation state for connection weight $\omega_{\text{baby}\_\text{born}\_AIC, type\_com\_AIC}$	
X <sub>68</sub>	W <sub>type_mom_AIC</sub> , pre_birth_info_AIC	Reified representation state for connection weight $\omega_{\text{type\_mom\_AIC, pre\_birth\_info\_AIC}}$	
X <sub>69</sub>	Wpre_birth_info_AIC, pre_birth_info	Reified representation state for connection weight $\omega_{\text{pre_birth_info_AIC, pre_birth_info}}$	
X <sub>70</sub>	Wcalm_dad_AIC, acknowl_fat	Reified representation state for connection weight $\omega_{\text{calm}\_dad\_AIC, acknowl\_fat}$	
X <sub>71</sub>	Wteach_dad_sup_mom_AIC, acknowl_fat	Reified representation state for connection weight $\omega_{\text{teach}\_dad\_sup\_mom\_AIC, acknowl\_fat}$	
X <sub>72</sub>	Wcalm_dad_AIC, com_sup_hcp	Reified representation state for connection weight $\omega_{calm\_dad\_AIC, com\_sup\_hep}$	
X <sub>73</sub>	Wteach_dad_sup_mom_AIC, com_sup_hcp	Reified representation state for connection weight $\omega_{\text{teach}\_dad\_sup\_mom\_AIC, com\_sup\_hcp}$	
X <sub>74</sub>	Wcalm_dad_AIC, post_info_com_par	Reified representation state for connection weight $\omega_{\text{calm}_dad\_AIC, \text{ post}_info\_com\_par}$	First reification level
X <sub>75</sub>	Wteach_dad_sup_mom_AIC, post_info_com_par	Reified representation state for connection weight $\omega_{\text{teach}\_dad\_sup\_mom\_AIC, post\_info\_com\_par}$	This remeation level
X <sub>76</sub>	Wencourage_mom_AIC, post_info_com_par	Reified representation state for connection weight $\omega_{\text{encourage}\_mom\_AIC, post\_Info\_com\_par}$	
X <sub>77</sub>	Wrefer_mom_ther_AIC, refer_therapist	Reified representation state for connection weight $\omega_{\text{refer\_mom\_ther\_AIC, refer\_therapist}}$	
X <sub>78</sub>	Wcalm_dad_AIC, mental_sup	Reified representation state for connection weight $\omega_{calm\_dad\_AIC, mental\_sup}$	
X <sub>79</sub>	Wteach_dad_sup_mom_AIC, mental_sup	Reified representation state for connection weight $\omega_{\text{teach}\_dad\_sup\_mom\_AIC, mental\_sup}$	
X <sub>80</sub>	Wencourage_mom_AIC, mental_sup	Reified representation state for connection weight $\omega_{\text{encourage}\_mom\_AIC, mental\_sup}$	
X <sub>81</sub>	Wrefer_mom_ther_AIC, mental_sup	Reified representation state for connection weight $\omega_{\text{refer\_morn\_ther\_AIC, mental\_sup}}$	
X <sub>82</sub>	W <sub>type_com_AIC</sub> , type_com	Reified representation state for connection weight $\omega_{\text{type_com_AIC, type_com}}$	
X <sub>83</sub>	monitor_pre_birth_info	State monitoring AIC mental model state pre_birth_info_AIC and world state pre_birth_info	
X <sub>84</sub>	monitor_acknowl_fat1	State monitoring AIC mental model state teach_dad_sup_mom_AIC and world state acknowl_fat	
X <sub>85</sub>	monitor_acknowl_fat <sub>2</sub>	State monitoring AIC mental model state calm_dad_AIC and world state acknowl_fat	
X <sub>86</sub>	monitor_com_sup_hcp1	State monitoring AIC mental model state calm_dad_AIC and world state com_sup_hcp	
X <sub>87</sub>	monitor_com_sup_hcp2	State monitoring AIC mental model state teach_dad_sup_mom_AIC and world state com_sup_hcp	
X <sub>88</sub>	monitor_post_info_com_par1	State monitoring AIC mental model state encourage_mom_AIC and world state post_info_com_par	
X <sub>89</sub>	monitor_post_info_com_par2	State monitoring AIC mental model state calm_dad_AIC and world state post_info_com_par	
X <sub>90</sub>	monitor_post_info_com_par <sub>3</sub>	State monitoring AIC mental model state teach_dad_sup_mom_AIC and world state post_info_com_par	
X <sub>91</sub>	monitor_refer_therapist	State monitoring AIC mental model state refer_mom_ther_AIC and world state refer_therapist	
X <sub>92</sub>	monitor_mental_sup1	State monitoring AIC mental model state encourage_mom_AIC and world state mental_sup	
X <sub>93</sub>	monitor_mental_sup <sub>2</sub>	State monitoring AIC mental model state refer_mom_ther_AIC and world state mental_sup	
X <sub>94</sub>	monitor_mental_sup <sub>3</sub>	State monitoring AIC mental model state calm_dad_AIC and world state mental_sup	
X <sub>95</sub>	monitor_mental_sup <sub>4</sub>	State monitoring AIC mental model state teach_dad_sup_mom_AIC and world state mental_sup	
X <sub>96</sub>	monitor_type_com	State monitoring AIC mental model state type_com_AIC and world state type_com	

The mental model (light grey oval) of the HCP in the base level of the model shows which internal simulations a HCP can have during the childbirth process. There are four separate process models within the mental model, each with end states (bold), that connect to one of the communication actions and/or context states in the world states.

The baby is born, which affects the **type of communication** used The type of mother, whether she is nulliparous or multiparous, determines whether any **special information has to be communicated before childbirth**. In the interest of space, type of mother is shortened to type of mom in the figures and tables.

The HCP determines that there is a deviation in the childbirth process. They determine the risk level associated with this deviation and, in return, **encourage the mother** while **calming the father**. When the baby is born, especially if born prematurely, the HCP assumes the possibility of irregular birth weight of the child. Once the child is classified as being underweight, they **refer the mother to a therapist** and **teach the father how to support the mother**.

# 4.2. First-Order Self-Model level of the adaptive network model

In this section, we present the first-order adaptive network level for the base model designed in Section 4.1. First-order adaptive networks model plasticity; changes in brain structure for learning through 'Hebbian Learning' principle (Hebb, 1949). First, we will discuss how HCP learns to communicate to the father by adding additional **W**-states on the first reification level, which determines the weight of the connection on the base level. Second, we present how a virtual safety coach (AIC) can facilitate communication using the shared mental models. Therefore, it has both **W**- and **H**-states on the first reification level. These states determine the weight of connections, and the speed factor of the connections on the base level, respectively. Third, we present how a virtual safety coach can monitor the communication during the procedure by adding both **W**-states and monitor states on the first reification level.

## 4.2.1. Healthcare practitioner learns to communicate

Additionally, to the base level described above (see Section 4.1), Fig. 2, has a middle level (red parallelogram), to represent the first level or the self-model of the base model using reification level states. This level contains eight **W**-states (red), which represent the weight of the connections within the HCP mental model on the base level. The detailed description of these states can be found in Table 3.

# 4.2.2. The Role of the Virtual safety Coach

This paper aims to model and determine the usability and effectiveness in having a virtual AI Coach (AIC) present. The main goal of the coach is to reduce the risk of maternal and paternal postpartum depression. This coach is aware of deviations in the process of the communication actions, and may intervene to provide support to the health practitioner(s) to correct them. Thus the related actions can be in



Fig. 4. Connectivity of First-Order Adaptive Network Model Case (c).

First- and Second-Order Self-Model States (or First and Second Reification Level States).

State Number	State Name	Explanation	Level		
X <sub>97</sub>	W <sub>W_AIC,W_HCP</sub>	Reified representation state for connection weight $\omega_{W_{i},AIC,W_{i},HCP}$ for the connection between the reified representation states $X_{61}$ - $X_{68}$ and $X_{51}$ - $X_{60}$ , respectively	Second reification level		
X <sub>98</sub>	con_feedback	Context state for learning of the HCP from the AIC	Second remeation level		
X <sub>99</sub>	Wbirth_dev_det_E, det_risk_level_E	Representation state for the experts knowledge about birth_dev_det_E, det_risk_level_E			
X <sub>100</sub>	W_det_risk_level_E, encourage_mom_E	Reified representation state for connection weight $\omega_{det, risk_{i}level_{i}, E_{i}, encourse_{i}, mom_{i}, E_{i}}$			
X <sub>101</sub>	Wdist_risk_level_E, calm_dad_E Relified representation state for connection weight Wdet_risk_level_E, calm_dad_E				
X <sub>102</sub>	Wirr, birth, weight, E, det_underw, E Relified representation state for connection weight wirr, birth, weight, E, det_underw, E				
X <sub>103</sub>	W_det_underw_E, refer_mom_ther_E	her_E Reified representation state for connection weight ω <sub>det_underw_E</sub> , refer_mom_ther_E			
X <sub>104</sub>	W_det_underw_E, teach_dad_sup_mom_E	h. dad_sup_mom_E Reified representation state for connection weight $\omega_{det_uindew_E, teach_add_sup_mom_E}$			
X <sub>105</sub>	Wbaby_born_E, type_com_E	Reified representation state for connection weight $\omega_{baby, born, \xi, type, com, \xi}$			
X <sub>106</sub>	W <sub>type_mom_E</sub> , pre_birth_info_E	Reified representation state for connection weight $\omega_{type,mom, E, pre, birth, into, E}$			
X <sub>107</sub>	W <sub>W_E,W_AIC</sub>	Reified representation state for connection weight $\mathbf{\omega}_{W,E,W,ARC}$ for the connection between the reified representation states $X_{99}$ - $X_{106}$ and $X_{61}$ - $X_{68}$ , respectively	Second reification level		
X <sub>108</sub>	con_feedforward	Context state for learning of the AIC from the E	Second remcation rever		

terms of altering the HCP of a forgotten action or communicating with the father itself (upon approval by an HCP). Thus, the Virtual AI Coach (AIC) will not only help the healthcare practitioner to monitor the process for communication, but also will facilitate them for communication, and in return avoiding adverse possible effects like PPPD and MPPD. Therefore, here, we present an extension to contain the Virtual AI Coach (Fig. 3) that intervenes when necessary in terms of communication with the father of the child. This was done by duplicating the mental model of the HCP for the Coach. The states, as well as all connections within the mental model and to the world states are identical.

The middle level was also duplicated, meaning eight W-states (green) were created to represent the weight of the connections within the Coach mental model. In addition, seven new states were added to this level. Six of these additional states are H-states (green), which have connections to one of each of the end states within the Coach mental model. The H-states represent time activation of the end states and are controlled by the seventh state (blue), a context state that activates the Coach at a particular time. A detailed explanation of the additional states is given in Table 4.

# 4.2.3. Dynamic monitoring by the Virtual Coach

To create a more dynamic Virtual Coach, a further model (Fig. 4) was created. The goal of this Coach is not to be activated by time; instead, we designed a 'monitor' function (see Table 1). This function is responsible for monitoring the communication and context states affected by the end

states of the mental models. Therefore, if insufficient activation of those states is detected (through a parameter called threshold -  $\tau$ ) by the Coach, then the Coach activates the corresponding part of its mental model, which results in the Coach performing the communication action instead of the HCP.

This model of monitoring role of the virtual AI Coach differs in the number of nodes in the middle level. The 16 W-states representing the weight of the connections for both mental models in the base level persist. However, the seven additional states mentioned in Section 4.2.2 were removed. Instead, 14 new W-states (green) that represent the weight of connections were added. These states represent the weight of connections between the end states of the mental model of the Virtual AI Coach and the world states affected by them. Moreover, 14 monitor states (blue), each with an outgoing connection to one of the new states mentioned earlier, were included that receive input from the base level and determine whether to activate their corresponding states based on the monitor combination function described in Table 1. A more in-depth explanation of the states in the middle level can be seen in Table 5.

# 4.3. Second-Order adaptive network model - organizational learning (feed forward and feedback)

The Second-Order Adaption Level adds another abstraction level of learning to the states modelled on first-order network using *meta*-plasticity principle. At this level, context states were added along with **W**<sub>W</sub>-



Fig. 5. Connectivity of Second-Order Adaptive Network Model Case (d).

states on the second reification level. It is to be noted that eight more W states are introduced on the first-order level in relation to organizational learning. This final addition to the model was done by incorporating an expert (Fig. 5) of the organization.

The goal with adding an expert (E) was to show the possibility of the Virtual AI Coach learning from a practitioner with a complete mental model. Moreover, the Coach, having acquired this knowledge, can then pass it on to the HCP. In this case the Coach's mental model is interpreted as a shared mental model. This creates a more adaptive Virtual Coach, as it allows for the constant addition of information from an expert (as feed forward learning). This information is then relayed (feedback learning) to the HCPs after childbirth, making it an increasingly more valuable asset within a hospital setting and depicting organizational learning.

The set-up of the model is as follows. The base-level remains the same as in Section 4.2.2 and 4.2.3. The reason the expert is not being included in the actual process, is that he/she is a tool for teaching the Coach, while not being actively on the floor when the HCP and Coach work in cohesion. The middle level is the same as in 4.2.3, with the addition of eight W-states (purple) representing the knowledge of an expert. Each of these states has a link (light blue) from them to their counterpart of the eight original W-states corresponding to the Coach. Moreover, as the HCP can learn from the Coach, an additional eight links (light blue), with the same setup as mentioned before, were added from the Coach W-states to the HCP W-states.

In the second-order self-model level, two  $W_W$ -states -states (dark blue) were included, as well as two context states (blue). The  $W_W$ -states -states represent the horizontal connection weights (light blue) between the Expert (E) and the Coach, as well as between the Coach and Healthcare Practitioner (HCP). Therefore, the left most one has downward connections (dark blue) to the Coach W-states, and the right most one has downward connections (dark blue) to the HCP W-states. The context state con\_feedforward creates an initial shared mental model of the knowledge necessary. The context state con\_feedback updates the individual mental model, of the HCP in this case, with the information from the shared mental model. The detailed descriptions of the newly added states can be seen in the Appendices section.

# 5. Simulation results

This section presents the assumption made to simulate the model, along with the simulation results obtained from the designed model presented in Section 4.

# 5.1. Assumptions considered for simulation

While most states are dynamic, meaning they depend on the impact of other states, a handful of states within the models have manually chosen values given their binary nature.

- 1. The type of mother, either nulliparous or multiparous, was assigned a fixed value of 0, which corresponds to the mother being nulliparous.
- 2. The artificiality of birth, either being natural or caesarean section, was assigned a fixed value of 0, which corresponds to the mother having a natural birth.
- 3. The type of birth, either being no/little risk or high risk, was assigned a fixed value of 0, which corresponds to there being no risk.
- 4. The pre-birth information either being extra information is needed or not, was assigned a fixed value of 0, which corresponds to there being no need for additional information.
- 5. The age, either between the ages of 25–29 or not, was assigned a fixed value of 1, corresponding to the mother being between 25 and 29 years old.
- 6. Premature birth, either the birth being premature or not, was assigned a fixed value of 1, which corresponds to it being a premature birth.

Moreover, certain states had concrete specifications.

1. The starting value for maternal postpartum depression (MPPD) was set at 0.13, which is median of the probability of a woman developing postpartum depression (p. 526 - (Dennis, 2004))



Fig. 6. Simulation Results for Successful Communication between HCP and Parents of the Child.



Fig. 7. Simulation Results for Poor Communication between the HCP and the Parents.

- 2. The state for dilation of the mother increases and reaches a maximum at 0.8, which represents full dilation of 10 cm ((NHS), 2020).
- 3. Once the dilation of the mother reaches 0.8, the state 'baby\_born' is activated and increases quickly to 1 (Hueston, 1998).

The time points (t) are referred to as unit time and have a value range between 0 and 80. This range for t is selected for an impression. However, it can also have a different range, and can be interpreted in minutes or hours. Moreover, the choice that a deviation occurs during childbirth, as well as the birth being premature, was deliberate, to show the effects of proper communication in a scenario where complications arise. In addition, the mother was set up with the best conditions to not develop MPPD. This can be seen by a slower increase of the line in the simulations compared to PPPD.

Furthermore, an active mental model is defined by the end states of the four mental processes specified earlier (See Section 4). Meaning all states, except the end states, may be active, as there is internal knowledge of what is occurring in front of them. However, this does not result in further communication actions. For example, the HCP is aware of there being a birth deviation but does not follow through with the further steps that then elicit the communication action.

Lastly, since the goal of this paper is to observe and show how to reduce the risk of maternal (light blue) and paternal (red) postpartum depression and in return reducing the risk of impeding child development (dark blue), their corresponding lines were made bold.

# 5.2. Communication with the parents

# 5.2.1. Adequate communication between healthcare practitioners and parents

Here, we present a scenario of successful communication between parents and Healthcare Practitioner (HCP) during the childbirth process. The time duration is from 0 to 40 (*t*-axis) with a step size of  $\Delta t = 0.1$ .



Fig. 8. Simulation Results for Case (b) - AIC Intervenes.



Fig. 9. Simulation Results for Case (c) - AIC Monitors.

The low step size results in smoother curves in the simulation graphs.

At first, the healthcare practitioner is set to have a perfect mental model (all HCP's W-states are constant 1). The simulation shown in Fig. 6 depicts this scenario. The trend lines of the three bold states first increase since a deviation occurs, and risk and fear persist. However, once adequate support from the HCP to the father sets in, there is a fast decrease, eventually reaching 0. MPPD also decreases, as a result of the risk of PPPD decreasing, since the father being healthy allows for adequate support of the mother.

# 5.2.2. Ineffective communication between HealthCare practitioners and parents

In comparison to the simulation above, a further scenario was simulated (Fig. 7) to show the effects of imperfect communication of the HCP. When performing this simulation, all values were kept the same, except for the values of states in the mental model of the HCP. In this simulation, the HCP does not have an active mental model that facilitates proper communication (all HCP's W-states are constant 0).

When comparing Fig. 6 and Fig. 7, one can clearly see the effects of a



Fig. 10. Simulation Results for Case (d) - Expert Teaches AIC, AIC Monitors, AIC teaches, HCP.

lack of communication support from the HCP to the parents. While in Fig. 6, all risk-representing bold states increase, but promptly decrease again to reach 0, in Fig. 7, they all depict only an increase. At roughly t = 25, PPPD and imp\_kid\_devel correct themselves once the risk factor has subsided but remain high until the end of the time span. Moreover, MPPD has a steadily increasing trend, with no indication of decreasing whatsoever.

# 5.3. The Role of the Virtual Coach

In this scenario, the virtual AI Coach (AIC) steps in to communicate when a healthcare practitioner doesn't attend to the father and mother appropriately during childbirth. The simulation (Fig. 8) has a time duration from 0 to 60 (*t*-axis) with a step size of  $\Delta t = 0.1$ . An increase of the time duration, in comparison to previous simulation (see Section 5.2), compensates for the late activation of the communication actions.

The end states of the HCP never get activated and remain at 0, which results in no communication taking place from the HCP's side. This is due to the fact that the W-states are at 0 for the HCP. There exists an exception to this rule, as the calm\_dad\_HCP state gets activated briefly upon the fat\_ask\_sup\_com state. Given the father approaching a HCP to ask for support, the HCP will act on being approached, even if their own initiative isn't there. This is visible by the two purple lines that reach their maximum at around t = 30.

On the other hand, the **W**-states for the AIC are at 1, meaning the respective mental model is active. The intervention (con\_act\_AIC) of the AIC starts at t = 20 (red line). The rapid change from 0 to 1 of this state, consequently, affects the communication action mental model states of the AIC. Before t = 20 these states had a slow increasing trend with little effect on the PPPD, MPPD and imp\_kid\_devel states. Promptly after the intervention, a rapid growth of the trend lines of the AIC mental model end states can be observed. This is a result of the H-states (purple line). This activation of the mental model translates into real-world support, which prompts, amongst others, the desire\_sup state to decrease. The effects of this intervention can be observed by the three bold trend lines, which change course to decrease at around t = 24. Simultaneously to

the end states of the AIC mental model reaching 1, the risk of PPPD and the risk of imp\_kid\_devel reach 0, followed by the risk of MPPD shortly after.

# 6. Dynamic Context-Sensitive Monitoring by the Virtual Coach

This is a similar scenario where a healthcare practitioner doesn't attend to the father and mother appropriately during the childbirth process. However, here, the Coach acts in a more context-sensitive manner. It is actively monitoring the relevant world states and intervenes only when it doesn't detect enough activation. The simulation (Fig. 9) has a time duration from 0 to 60 (*t*-axis) with a step size of  $\Delta t = 0.1$ .

Similarly to the role of the coach (discussed in Section 4.2.2 and 5.3), the HCP mental model does not get activated for the same reasons (W-states constant 0). Moreover, the W-states for AIC are also the same (constant 1). The reason for them being 1 is because the AI Coach is supposed to have perfect knowledge from the beginning. The mental model of the AIC is active starting between t = 0 to t = 12. The interesting aspect about this model are the monitoring states. These activate in the range of t = 15 to t = 20, as well as from t = 35 to t = 48.

Taking type\_com (red line at t = 20) as an example state, the sequences of how the monitors activate will be explained. State type\_com\_AIC (blue line at t = 17), which is the mental model state of the AIC for the type of communication, activates first, since the AI Coach has a perfect mental model. This is followed by the monitor\_type\_com (green high spike at t = 20) state, which in return activates W\_type\_com\_AIC, type\_com (green low spike at t = 20) to effectuate the communication intended by AIC. The process that occurs here is that the monitor state observes the type\_com and type\_com\_AIC states and, by applying the monitor function (see Table 1), determines whether it must act to compensate for missing actions in the real world. This occurs by strengthening the W\_type\_com\_AIC, type\_com connection weight state. As a result of the strengthening, the type\_com context state gets activated, which means it is being translated into a real-world action: the communication from the AIC actually takes place.

Role Matrix for Best Case (a) for mb - Base Connectivity.

	mb - base connectivity	1	2	3		4 5	6	7	8
X <sub>1</sub>	type_mom	X <sub>1</sub>							
X <sub>2</sub>	artificiality_birth	X <sub>2</sub>	X <sub>18</sub>						
X <sub>3</sub>	epidural_used	X <sub>3</sub>							
X <sub>4</sub>	deliv_baby	X <sub>4</sub>	X <sub>19</sub>						
X <sub>5</sub>	baby_born	X <sub>4</sub>							
X <sub>6</sub>	MPPD	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>5</sub>	X <sub>15</sub>			
X <sub>7</sub>	PPPD	X <sub>6</sub>	X <sub>10</sub>	X <sub>12</sub>	X <sub>15</sub>	X <sub>23</sub>	X <sub>24</sub>		
X <sub>8</sub>	imp_kid_devel	X <sub>7</sub>							
Х <sub>9</sub>	pre_birth_info	X <sub>9</sub>	X <sub>40</sub>						
X <sub>10</sub>	com_sup_hcp	X <sub>4</sub>	X <sub>9</sub>	X <sub>11</sub>	X <sub>24</sub>	X <sub>30</sub>	X <sub>32</sub>	X <sub>34</sub>	X <sub>36</sub>
X <sub>11</sub>	fat_ask_sup_com	X <sub>23</sub>	X <sub>28</sub>						
X <sub>12</sub>	fat_rec_sup_com	X <sub>10</sub>	X <sub>22</sub>	X <sub>24</sub>					
X <sub>13</sub>	post_info_com_par	X <sub>5</sub>	X <sub>20</sub>	X <sub>31</sub>	X <sub>32</sub>	X <sub>36</sub>			
X <sub>14</sub>	refer_therapist	X <sub>13</sub>	X <sub>35</sub>						
X <sub>15</sub>	mental_sup	X <sub>14</sub>	X <sub>21</sub>	X <sub>31</sub>	X <sub>32</sub>	X <sub>35</sub>	X <sub>36</sub>		
X <sub>16</sub>	acknowl_fat	X <sub>9</sub>	X <sub>32</sub>	X <sub>36</sub>					
X <sub>17</sub>	age	X <sub>17</sub>							
X <sub>18</sub>	riskiness	X <sub>5</sub>	X <sub>17</sub>						
X <sub>19</sub>	dilation_mom	X <sub>19</sub>							
X <sub>20</sub>	premature_birth	X <sub>20</sub>							
X <sub>21</sub>	type_com	X <sub>21</sub>	X <sub>38</sub>						
X <sub>22</sub>	retention	X <sub>23</sub>	X <sub>24</sub>						
X <sub>23</sub>	engaged	X <sub>16</sub>							
X <sub>24</sub>	stress	X <sub>26</sub>							
X <sub>25</sub>	birth_dev	X <sub>4</sub>	X <sub>18</sub>						
X <sub>26</sub>	fear_level	X <sub>23</sub>	X <sub>24</sub>	X <sub>25</sub>					
X <sub>27</sub>	desire_sup	X <sub>26</sub>							
X <sub>28</sub>	ask_sup	X <sub>27</sub>							
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	X <sub>4</sub>	X <sub>18</sub>						
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	X <sub>29</sub>							
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	X <sub>30</sub>							
X <sub>32</sub>	calm_dad <sub>HCP</sub>	X <sub>11</sub>	X <sub>30</sub>						
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	X <sub>5</sub>	X <sub>20</sub>						
X <sub>34</sub>	det_underw <sub>HCP</sub>	X <sub>33</sub>							
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	X <sub>34</sub>							
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	X <sub>34</sub>							
X <sub>37</sub>	baby_born <sub>HCP</sub>	X <sub>5</sub>							
X <sub>38</sub>	type_com <sub>HCP</sub>	X <sub>37</sub>							
X <sub>39</sub>	type_mom <sub>HCP</sub>	X <sub>1</sub>							
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	X <sub>39</sub>							
X <sub>41</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	X <sub>41</sub>							
X <sub>42</sub>	W_det_risk_level_HCP, encourage_mom_HCP	X <sub>42</sub>							
X <sub>43</sub>	$W_{det\_risk\_level\_HCP, calm\_dad\_HCP}$	X <sub>43</sub>							
X <sub>44</sub>	Wirr_birth_weight_HCP, det_underw_HCP	X <sub>44</sub>							
X <sub>45</sub>	$\mathbf{W}_{det\_underw\_HCP, refer\_mom\_ther\_HCP}$	X <sub>45</sub>							
X <sub>46</sub>	$\mathbf{W}_{det\_underw\_HCP,teach\_dad\_sup\_mom\_HCP}$	X <sub>46</sub>							
X <sub>47</sub>	Wbaby_born_HCP, type_com_HCP	X <sub>47</sub>							
X <sub>48</sub>	W <sub>type_mom_HCP</sub> , pre_birth_info_HCP	X <sub>48</sub>							

The overall time-span for the bold lines to decrease and eventually reach zero is higher than in the previous two cases, however the same outcome is eventually reached. This is a result of the increased duration due to the monitoring having to take place before the AIC can act. The speed factors for the AIC were chosen this way to make it not too fast, as it would be a disadvantage if the HCP didn't have time to start acting, before the AIC stepped in.

# 6.1. The role of organizational learning

In this scenario, a healthcare practitioner initially has no knowledge

for the appropriate mental model and doesn't attend to the father and mother appropriately during the childbirth process. However, in this case, we present the process of organizational learning by which HCP would improve its mental model, by acquiring shared knowledge. In this case, the AI Coach get on the role of maintaining the organization's shared mental knowledge. It acquires it first by feed forward learning. This is based on an expert teaching the AI Coach, thus creating a shared mental model. Then later in the process feedback learning takes place: this shared mental model is transferred to HCP (after the childbirth process). In this way, this simulation depicts organizational learning. The timing was a deliberate choice, as teaching the HCP during

Role Matrix for Best Case (a) for mcw - Connection Weights.



childbirth could result in increased stress levels and, in return, possibly have an adverse effect on the communication actions. Similar to our previous simulation results (Section 5.4), the AI Coach uses monitors to determine if or when to take an action. The simulation (Fig. 10) has a time duration from 0 to 80 (*t*-axis) with a step size of  $\Delta t = 0.1$ . The increased time duration is to have a full illustration of the learning phase of the HCP after the childbirth process.

This scenario follows a similar trend as dynamic monitoring (Section 5.4), given that the HCP has a non-active mental model. Meaning the actions that take place to reduce the three bold line states are identical to what is described above. The notable difference is the learning of the AIC

from the expert. The left most line represents the  $W_W$ -states of the expert to the AIC (light red), which strengthens the connection weights, meaning the AIC acquires all the information and a shared mental model has been established. Moreover, the learning of the HCP from the AIC is activated by the con\_feedback state (purple) at t = 40. At around t = 48, the  $W_W$ -states (light blue) of the AIC to the HCP begin to increase. This activates the W-states of the HCP and in return strengthens the mental model connection weights. The HCP learns between t = 50 and t = 60.

Role Matrix for Best Case (a) for mcfw – Combination Function Weights.

mcfw	1	
		Alogistic
X <sub>1</sub>	type_mom	1
X <sub>2</sub>	artificiality_birth	1
X <sub>3</sub>	epidural_used	1
X <sub>4</sub>	deliv_baby	1
X <sub>5</sub>	baby_born	1
X <sub>6</sub>	MPPD	1
X <sub>7</sub>	PPPD	1
X <sub>8</sub>	kid_devel	1
X <sub>9</sub>	pre_birth_info	1
X <sub>10</sub>	com_sup_hcp	1
X <sub>11</sub>	fat_ask_sup_com	1
X <sub>12</sub>	fat_rec_sup_com	1
X <sub>13</sub>	post_info_com_par	1
X <sub>14</sub>	refer_therapist	1
X <sub>15</sub>	mental_sup	1
X <sub>16</sub>	acknowl_fat	1
X <sub>17</sub>	age	1
X <sub>18</sub>	riskiness	1
X <sub>19</sub>	dilation_mom	1
X <sub>20</sub>	premature_birth	1
X <sub>21</sub>	type_com	1
X <sub>22</sub>	retention	1
X <sub>23</sub>	engaged	1
X <sub>24</sub>	stress	1
X <sub>25</sub>	birth_dev	1
X <sub>26</sub>	fear_level	1
X <sub>27</sub>	desire_sup	1
X <sub>28</sub>	ask_sup	1
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	1
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	1
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	1
X <sub>32</sub>	calm_dad <sub>HCP</sub>	1
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	1
X <sub>34</sub>	det_underw <sub>HCP</sub>	1
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	1
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	1
X <sub>37</sub>	baby_born <sub>HCP</sub>	1
X <sub>38</sub>	type_com <sub>HCP</sub>	1
X <sub>39</sub>	type_mom <sub>HCP</sub>	1
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	1
X <sub>41</sub>	Wbirth dev det HCP, det risk level HCP	1
X <sub>42</sub>	W <sub>det risk level HCP encourage mom HCP</sub>	1
X <sub>43</sub>	W <sub>det risk level HCP</sub> calm dad HCP	1
X <sub>44</sub>	Wirr birth weight HCP. det underw HCP	1
X <sub>45</sub>	W <sub>det underw HCP, refer mom ther HCP</sub>	1
X <sub>46</sub>	W <sub>det underw HCP, teach dad sun mom HCP</sub>	1
X <sub>47</sub>	What horn HCP type com HCP	1
X <sub>48</sub>	W <sub>type</sub> mom HCP, pre_birth_info_HCP	1
	-/be_mem_mer/bre_onth_mo_mer	

# Table 9

Role Matrix for Best Case (a) for mcfp – Combination Function Parameters.

		1 Alogistic				
	mcfp - combination function parameters	Steepness	Threshold			
X <sub>1</sub>	type_mom	50	0.5			
X <sub>2</sub>	artificiality_birth	50	0.5			
X <sub>3</sub>	epidural_used	50	0.5			
X <sub>4</sub>	deliv_baby	5	0.5			
X5	baby_born	50	0.5			
X <sub>6</sub>	MPPD	5	0.3			
X <sub>7</sub>	PPPD	5	0.5			
X <sub>8</sub>	kid_devel	5	0.5			
X <sub>9</sub>	pre_birth_info	50	0.5			
X <sub>10</sub>	com_sup_hcp	0.5	6			
X <sub>11</sub>	fat_ask_sup_com	5	1			
X <sub>12</sub>	fat_rec_sup_com	5	0.5			
X <sub>13</sub>	post_info_com_par	5	4			
X <sub>14</sub>	refer_therapist	5	1			
X <sub>15</sub>	mental_sup	5	5			
X <sub>16</sub>	acknowl_fat	5	0.8			
X <sub>17</sub>	age	5	0.5			
X <sub>18</sub>	riskiness	50	0.5			
X <sub>19</sub>	dilation_mom	2.8	0			
X <sub>20</sub>	premature_birth	5	0.5			
X <sub>21</sub>	type_com	5	0.1			
X <sub>22</sub>	retention	5	0.3			
X <sub>23</sub>	engaged	5	0.5			
X <sub>24</sub>	stress	5	0.5			
X <sub>25</sub>	birth_dev	50	1			
X <sub>26</sub>	fear_level	5	1			
X <sub>27</sub>	desire_sup	5	0.3			
X <sub>28</sub>	ask_sup	5	0.2			
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	5	1			
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	5	0.5			
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	5	0.5			
X <sub>32</sub>	calm_dad <sub>HCP</sub>	50	0.7			
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	5	1			
X <sub>34</sub>	det_underw <sub>HCP</sub>	5	0.5			
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	50	0.5			
Х <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	50	0.7			
X <sub>37</sub>	baby_born <sub>HCP</sub>	5	0.5			
X <sub>38</sub>	type_com <sub>HCP</sub>	50	0.5			
X <sub>39</sub>	type_mom <sub>HCP</sub>	5	0.5			
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	50	0.5			
X <sub>41</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	5	0.5			
X <sub>42</sub>	W <sub>det_risk_level_HCP</sub> , encourage_mom_HCP	5	0.5			
X <sub>43</sub>	$\mathbf{W}_{det\_risk\_level\_HCP,calm\_dad\_HCP}$	5	0.5			
X <sub>44</sub>	Wirr_birth_weight_HCP, det_underw_HCP	5	0.5			
X <sub>45</sub>	$\mathbf{W}_{det\_underw\_HCP}$ , refer_mom_ther_HCP	5	0.5			
X <sub>46</sub>	W_det_underw_HCP, teach_dad_sup_mom_HCP	5	0.5			
X <sub>47</sub>	W <sub>baby_born_HCP, type_com_HCP</sub>	5	0.5			
X <sub>48</sub>	W <sub>type</sub> mom HCP, pre birth info HCP	5	0.5			

# 7. An environment for the Virtual safety Coach

The models designed and simulated in this study explain how using a Virtual Safety Coach can improve communication among healthcare practitioner and father. The Virtual AI Coach will be designed to use these models, with the aim to facilitate the medical practitioners to achieve their goals without any possible omission or other error. In other words, the Safety Coach would mainly rely on similar mental models to facilitate the healthcare practitioners.

Role Matrix for Best Case (a) for iv – Initial Values.

	ms - speed factors	1
X <sub>1</sub>	type_mom	1
X <sub>2</sub>	artificiality_birth	1
X <sub>3</sub>	epidural_used	1
X <sub>4</sub>	deliv_baby	0.2
X <sub>5</sub>	baby_born	0.1
X <sub>6</sub>	MPPD	0.2
X <sub>7</sub>	PPPD	1
X <sub>8</sub>	kid_devel	1
X <sub>9</sub>	pre_birth_info	0.1
X <sub>10</sub>	com_sup_hcp	0.1
X <sub>11</sub>	fat_ask_sup_com	0.3
X <sub>12</sub>	fat_rec_sup_com	0.1
X <sub>13</sub>	post_info_com_par	0.1
X <sub>14</sub>	refer_therapist	0.3
X <sub>15</sub>	mental_sup	0.1
X <sub>16</sub>	acknowl_fat	0.1
X <sub>17</sub>	age	0
X <sub>18</sub>	riskiness	0.5
X <sub>19</sub>	dilation_mom	1
X <sub>20</sub>	premature_birth	0
X <sub>21</sub>	type_com	1
X <sub>22</sub>	retention	1
X <sub>23</sub>	engaged	1
X <sub>24</sub>	stress	0.4
X <sub>25</sub>	birth_dev	1
X <sub>26</sub>	fear_level	1
X <sub>27</sub>	desire_sup	1
X <sub>28</sub>	ask_sup	0.2
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	1
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	1
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	0.1
X <sub>32</sub>	calm_dad <sub>HCP</sub>	0.1
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	1
X <sub>34</sub>	det_underw <sub>HCP</sub>	1
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	0.3
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	0.1
X <sub>37</sub>	baby_born <sub>HCP</sub>	1
X <sub>38</sub>	type_com <sub>HCP</sub>	1
X <sub>39</sub>	type_mom <sub>HCP</sub>	1
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	1
X <sub>41</sub>	$\mathbf{W}_{birth\_dev\_det\_HCP}$ , det_risk_level_HCP	0
X <sub>42</sub>	$\mathbf{W}_{det\_risk\_level\_HCP,encourage\_mom\_HCP}$	0
X <sub>43</sub>	$\mathbf{W}_{det\_risk\_level\_HCP}$ , calm_dad_HCP	0
X <sub>44</sub>	Wirr_birth_weight_HCP, det_underw_HCP	0
X <sub>45</sub>	$\mathbf{W}_{det\_underw\_HCP, refer\_mom\_ther\_HCP}$	0
X <sub>46</sub>	$\mathbf{W}_{det\_underw\_HCP,teach\_dad\_sup\_mom\_HCP}$	0
X <sub>47</sub>	W <sub>baby_born_HCP, type_com_HCP</sub>	0
X <sub>48</sub>	<b>W</b> <sub>type_mom_HCP</sub> , pre_birth_info_HCP	0

# Table 11

Role Matrix for Best	Case (a) for n	ns – Speed Factors.
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	iv - initial values	1
X1	type mom	0
Xa	artificiality birth	0
Xa	epidural used	0
X,	deliv baby	0
, Ar	baby born	0
Xc	MPPD	0.13
X <sub>7</sub>	PPPD	0
, X <sub>8</sub>	kid devel	0
X	_ pre birth info	0
X <sub>10</sub>	com sup hcp	0
X <sub>11</sub>	fat ask sup com	0
X <sub>12</sub>	fat rec sup com	0
X <sub>13</sub>	post info com par	0
X <sub>14</sub>	refer_therapist	0
X <sub>15</sub>	mental_sup	0
X <sub>16</sub>	acknowl_fat	0
X <sub>17</sub>	age	1
X <sub>18</sub>	riskiness	0
X <sub>19</sub>	dilation_mom	0.2
X <sub>20</sub>	premature_birth	1
X <sub>21</sub>	type_com	0
X <sub>22</sub>	retention	0
X <sub>23</sub>	engaged	0
X <sub>24</sub>	stress	0
X <sub>25</sub>	birth_dev	0
X <sub>26</sub>	fear_level	0
X <sub>27</sub>	desire_sup	0
X <sub>28</sub>	ask_sup	0
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	0
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	0
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	0
X <sub>32</sub>	calm_dad <sub>HCP</sub>	0
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	0
X <sub>34</sub>	det_underw <sub>HCP</sub>	0
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	0
Х <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	0
Х <sub>37</sub>	baby_born <sub>HCP</sub>	0
X <sub>38</sub>	type_com <sub>HCP</sub>	0
X <sub>39</sub>	type_mom <sub>HCP</sub>	0
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	0
X <sub>41</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	1
X <sub>42</sub>	Wdet_risk_level_HCP, encourage_mom_HCP	1
X <sub>43</sub>	Wdet_risk_level_HCP, calm_dad_HCP	1
X <sub>44</sub>	Wirr_birth_weight_HCP, det_underw_HCP	1
X <sub>45</sub>	Wdet_underw_HCP, refer_mom_ther_HCP	1
X <sub>46</sub>	Wdet_underw_HCP, teach_dad_sup_mom_HCP	1
X <sub>47</sub>	Wbaby_born_HCP, type_com_HCP	1
X <sub>48</sub>	W <sub>type_mom_</sub> HCP, pre_birth_info_HCP	1

Role Matrix for Worst Case (a) for mb - Base Connectivity.

mb - base connectivity		1	2	3	4	5	6		7 8
X <sub>1</sub>	type_mom	X <sub>1</sub>							
X <sub>2</sub>	artificiality_birth	X <sub>2</sub>	X <sub>18</sub>						
X <sub>3</sub>	epidural_used	X <sub>3</sub>							
X <sub>4</sub>	deliv_baby	X <sub>4</sub>	X <sub>19</sub>						
X <sub>5</sub>	baby_born	X <sub>4</sub>							
X <sub>6</sub>	MPPD	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>5</sub>	X <sub>15</sub>			
X <sub>7</sub>	PPPD	X <sub>6</sub>	X <sub>10</sub>	X <sub>12</sub>	X <sub>15</sub>	X <sub>23</sub>	X <sub>24</sub>		
X <sub>8</sub>	imp_kid_devel	X <sub>7</sub>							
X <sub>9</sub>	pre_birth_info	X <sub>9</sub>	X <sub>40</sub>						
X <sub>10</sub>	com_sup_hcp	X <sub>4</sub>	X <sub>9</sub>	X <sub>11</sub>	X <sub>24</sub>	X <sub>30</sub>	X <sub>32</sub>	X <sub>34</sub>	X <sub>36</sub>
X <sub>11</sub>	fat_ask_sup_com	X <sub>23</sub>	X <sub>28</sub>						
X <sub>12</sub>	fat_rec_sup_com	X <sub>10</sub>	X <sub>22</sub>	X <sub>24</sub>					
X <sub>13</sub>	post_info_com_par	X <sub>5</sub>	X <sub>20</sub>	X <sub>31</sub>	X <sub>32</sub>	X <sub>36</sub>			
X <sub>14</sub>	refer_therapist	X <sub>13</sub>	X <sub>35</sub>						
X <sub>15</sub>	mental_sup	X <sub>14</sub>	X <sub>21</sub>	X <sub>31</sub>	X <sub>32</sub>	X <sub>35</sub>	X <sub>36</sub>		
X <sub>16</sub>	acknowl_fat	X <sub>9</sub>	X <sub>32</sub>	X <sub>36</sub>					
X <sub>17</sub>	age	X <sub>17</sub>							
X <sub>18</sub>	riskiness	X <sub>5</sub>	X <sub>17</sub>						
X <sub>19</sub>	dilation_mom	X <sub>19</sub>							
X <sub>20</sub>	premature_birth	X <sub>20</sub>							
X <sub>21</sub>	type_com	X <sub>21</sub>	X <sub>38</sub>						
X <sub>22</sub>	retention	X <sub>23</sub>	X <sub>24</sub>						
X <sub>23</sub>	engaged	X <sub>16</sub>							
X <sub>24</sub>	stress	X <sub>26</sub>							
X <sub>25</sub>	birth_dev	X <sub>4</sub>	X <sub>18</sub>						
X <sub>26</sub>	fear_level	X <sub>23</sub>	X <sub>24</sub>	X <sub>25</sub>					
X <sub>27</sub>	desire_sup	X <sub>26</sub>							
X <sub>28</sub>	ask_sup	X <sub>27</sub>							
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	X <sub>4</sub>	X <sub>18</sub>						
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	X <sub>29</sub>							
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	X <sub>30</sub>							
X <sub>32</sub>	calm_dad <sub>HCP</sub>	X <sub>11</sub>	X <sub>30</sub>						
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	X <sub>5</sub>	X <sub>20</sub>						
X <sub>34</sub>	det_underw <sub>HCP</sub>	X <sub>33</sub>							
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	X <sub>34</sub>							
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	X <sub>34</sub>							
X <sub>37</sub>	baby_born <sub>HCP</sub>	X <sub>5</sub>							
X <sub>38</sub>	type_com <sub>HCP</sub>	X <sub>37</sub>							
X <sub>39</sub>	type_mom <sub>HCP</sub>	X <sub>1</sub>							
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	X <sub>39</sub>							
X <sub>41</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	X <sub>41</sub>							
X <sub>42</sub>	W <sub>det_risk_level_HCP</sub> , encourage_mom_HCP	X <sub>42</sub>							
X <sub>43</sub>	W <sub>det_risk_level_HCP</sub> , calm_dad_HCP	X <sub>43</sub>							
X <sub>44</sub>	Wirr_birth_weight_HCP, det_underw_HCP	X <sub>44</sub>							
X <sub>45</sub>	W_det_underw_HCP, refer_mom_ther_HCP	X <sub>45</sub>							
X <sub>46</sub>	W_det_underw_HCP, teach_dad_sup_mom_HCP	X <sub>46</sub>							
X <sub>47</sub>	Wbaby_born_HCP, type_com_HCP	X <sub>47</sub>							
X <sub>48</sub>	W <sub>type_mom_HCP</sub> , pre_birth_info_HCP	X <sub>48</sub>							

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In network models, states and their causal relations are declarative by nature and can be represented by some connection weight, speed, and a combination function values (see Section 3.3 and 3.4). These values are used to compute the impact of a state by the incoming states. In particular, a combination function is responsible to compute the effect of the incoming states(s), which may vary as per the nature of the combination function used for them. To reflect various behaviors different functions ranging from simple standard functions like Euclidian (i.e., eucl(..)) to more complex ones like homophily (i.e., shhomo( $V_1, V_2, W$ )) were designed (Treur, 2016, 2020). A library was created, that offers these combination functions at one place. This library can be extended further, to reflect more behaviors, which have not been addressed before. Thus the library can be considered as a collection of various functions along with information describing them, for example:

Library{

id,// unique identifier of the combination function  $% \mathcal{A}(\mathcal{A})$ 

(continued on next column)

# (continued)

name,// the name of the function numberOfParams, //number of possible parameters params//names of the parameters

}

The combination functions included in the library follows a template

 $\mathrm{cf}_i(i,(p_1,p_2,\cdots,p_j),(V_1,\cdots,V_k))$ 

In principle, a state may have a number  $k \ge 0$  of incoming causal connections. Also, a combination function in the library may have j parameters ( $j = 0 \dots m$ ). For instance, the identity function does not take any parameter. However, a logistic homophily function takes three parameters. Detailed information related to combination function is available online (Treur, 2019). Moreover, a state is considered as a

Role Matrix for Worst Case (a) for mcw - Connection Weights.

m	icw - connection weights	1	2		3	4	5 6	j 7	8
X <sub>1</sub>	type_mom	1							
X <sub>2</sub>	artificiality_birth	1	-1						
X <sub>3</sub>	epidural_used	1							
X <sub>4</sub>	deliv_baby	1	1						
X <sub>5</sub>	baby_born	1							
X <sub>6</sub>	MPPD	0.25	0.25	0.25	0.25	-1			
X <sub>7</sub>	PPPD	1	-0.5	-0.5	-0.5	-0.5	1		
X <sub>8</sub>	kid_devel	1							
X <sub>9</sub>	pre_birth_info	1	1						
X <sub>10</sub>	com_sup_hcp	1	1	1	-1	1	1	1	1
X <sub>11</sub>	fat_ask_sup_com	1	1		_				
X <sub>12</sub>	fat_rec_sup_com	1	1	-1			_		
X <sub>13</sub>	post_info_com_par	1	1	1	1	1			
X <sub>14</sub>	refer_therapist	1	1						
X <sub>15</sub>	mental_sup	1	1	1	1	1	1		
X <sub>16</sub>	acknowl_fat	1	1	1					
X <sub>17</sub>	age	1							
X <sub>18</sub>	riskiness	-1	1						
X <sub>19</sub>	dilation_mom	1							
X <sub>20</sub>	premature_birth	1							
X <sub>21</sub>	type_com	1	1						
X <sub>22</sub>	retention	2	-1						
X <sub>23</sub>	engaged	1							
X <sub>24</sub>	stress	1							
X <sub>25</sub>	birth_dev	1	1						
X <sub>26</sub>	fear_level	-1	1	1					
X <sub>27</sub>	desire_sup	1							
X <sub>28</sub>	ask_sup	1							
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	1	1						
Х <sub>30</sub>	det_risk_level <sub>HCP</sub>	X <sub>41</sub>							
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	X <sub>42</sub>							
X <sub>32</sub>	calm_dad <sub>HCP</sub>	1	X <sub>43</sub>						
X <sub>33</sub>	Irr_birth_weight <sub>HCP</sub>	T V	2						
×34	uet_underW <sub>HCP</sub>	×44							
∧ <sub>35</sub>	terer_mom_ther <sub>HCP</sub>	×45							
×36	teach_dad_sup_mom <sub>HCP</sub>	A <sub>46</sub>							
^37 V		T V							
A <sub>38</sub>	type_com <sub>HCP</sub>	A <sub>47</sub>							
∧ <sub>39</sub> ∨	type_mom <sub>HCP</sub>	T T							
∧ <sub>40</sub>		∧ <sub>48</sub>							
X <sub>41</sub>	<pre>w birth_dev_det_HCP, det_risk_level_HCP W</pre>	1							
X	det_risk_level_HCP, encourage_mom_HCP	1							
X	•• det_risk_level_HCP, calm_dad_HCP	1							
X.5	Irr_birth_weight_HCP, det_underw_HCP	1							
X	•• det_underw_HCP, refer_mom_ther_HCP	1							
X45	vec_underw_HCP, teach_dad_sup_mom_HCP	1							
X49	W tupo mom HCP are hirth info LCD	1							

specification that can be defined as:

State{ initialValue, speedFactor, connectionWeight, output, cfData }

\_\_\_\_\_

For all state data (e.g., initial Value, speedFactor, weights), values range from 0 to 1, while output reflects the output of a state, that varies according to the causal impact of input states with respect to the time t. This output is computed using a combination function structured under the variable called 'cfData'. This consists of:

- **ImpactWeight:** How strong a specific combination function influences a state.
- **Parameters:** This contains the values of the parameters for the combination function used.

It is to be noted, that ImpactWeight facilitates the modelers to use different combination functions to study behaviors that are hybrid by

Role Matrix for Worst Case (a) for mcfw – Combination Function Weights.

T

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mcfw -	combination function weights	
X <sub>1</sub>	type mom	1
X <sub>2</sub>	artificiality birth	1
X3	epidural used	1
X <sub>4</sub>	deliv baby	1
Х <sub>5</sub>	baby born	1
X <sub>6</sub>	MPPD	1
X <sub>7</sub>	PPPD	1
X <sub>8</sub>	kid devel	1
X <sub>9</sub>	pre birth info	1
X <sub>10</sub>	com_sup_hcp	1
X <sub>11</sub>	fat_ask_sup_com	1
X <sub>12</sub>	fat_rec_sup_com	1
X <sub>13</sub>	post info com par	1
X <sub>14</sub>	refer_therapist	1
X <sub>15</sub>	mental_sup	1
X <sub>16</sub>	acknowl_fat	1
X <sub>17</sub>	age	1
X <sub>18</sub>	riskiness	1
X <sub>19</sub>	dilation_mom	1
X <sub>20</sub>	premature_birth	1
X <sub>21</sub>	type_com	1
X <sub>22</sub>	retention	1
X <sub>23</sub>	engaged	1
X <sub>24</sub>	stress	1
X <sub>25</sub>	birth_dev	1
X <sub>26</sub>	fear_level	1
X <sub>27</sub>	desire_sup	1
X <sub>28</sub>	ask_sup	1
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	1
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	1
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	1
X <sub>32</sub>	calm_dad <sub>HCP</sub>	1
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	1
X <sub>34</sub>	det_underw <sub>HCP</sub>	1
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	1
Х <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	1
Х <sub>37</sub>	baby_born <sub>HCP</sub>	1
Х <sub>38</sub>	type_com <sub>HCP</sub>	1
X <sub>39</sub>	type_mom <sub>HCP</sub>	1
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	1
X <sub>41</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	1
X <sub>42</sub>	Wdet_risk_level_HCP, encourage_mom_HCP	1
X <sub>43</sub>	W <sub>det_risk_level_HCP</sub> , calm_dad_HCP	1
X <sub>44</sub>	Wirr_birth_weight_HCP, det_underw_HCP	1
X <sub>45</sub>	Wdet_underw_HCP, refer_mom_ther_HCP	1
X <sub>46</sub>	Wdet_underw_HCP, teach_dad_sup_mom_HCP	1
X <sub>47</sub>	Wbaby_born_HCP, type_com_HCP	1
X <sub>48</sub>	$\mathbf{W}_{\text{type mom HCP, pre birth info HCP}}$	1

Table 15

Role Matrix for Worst Case (a) for mcfp – Combination Function Parameters.

	main combination function parameters	1 Alogistic					
	mctp - combination function parameters	Steepness	Threshold				
K <sub>1</sub>	type_mom	50	0.5				
<b>K</b> 2	artificiality_birth	50	0.5				
K <sub>3</sub>	epidural_used	50	0.5				
<b>K</b> 4	deliv_baby	5	0.5				
K <sub>5</sub>	baby_born	50	0.5				
K <sub>6</sub>	MPPD	5	0.3				
<b>K</b> 7	PPPD	5	0.5				
<b>≺</b> 8	kid_devel	5	0.5				
<b>(</b> 9	pre_birth_info	50	0.5				
<b>≺</b> 10	com_sup_hcp	0.5	6				
< <sub>11</sub>	fat_ask_sup_com	5	1				
<b>&lt;</b> 12	fat_rec_sup_com	5	0.5				
<b>≺</b> 13	post_info_com_par	5	4				
<b>≺</b> <sub>14</sub>	refer_therapist	5	1				
< <sub>15</sub>	mental_sup	5	5				
<b>≺</b> 16	acknowl_fat	5	0.8				
<b>≺</b> 17	age	5	0.5				
<b>≺</b> 18	riskiness	50	0.5				
<b>&lt;</b> 19	dilation_mom	2.8	0				
<b>≺</b> 20	premature_birth	5	0.5				
<b>&lt;</b> 21	type_com	5	0.1				
< <sub>22</sub>	retention	5	0.3				
< <sub>23</sub>	engaged	5	0.5				
<b>&lt;</b> 24	stress	5	0.5				
< <sub>25</sub>	birth_dev	50	1				
<b>≺</b> 26	fear_level	5	1				
< <sub>27</sub>	desire_sup	5	0.3				
<b>≺</b> 28	ask_sup	5	0.2				
< <sub>29</sub>	birth_dev_det <sub>HCP</sub>	5	1				
<b>≺</b> <sub>30</sub>	det_risk_level <sub>HCP</sub>	5	0.5				
<b>≺</b> 31	encourage_mom <sub>HCP</sub>	5	0.5				
K <sub>32</sub>	calm_dad <sub>HCP</sub>	50	0.7				
< <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	5	1				
<b>〈</b> <sub>34</sub>	det_underw <sub>HCP</sub>	5	0.5				
<35 ⟨	refer_mom_ther <sub>HCP</sub>	50	0.5				
<b>≺</b> 36	teach_dad_sup_mom <sub>HCP</sub>	50	0.7				
< <sub>37</sub>	baby_born <sub>HCP</sub>	5	0.5				
< <sub>38</sub>	type_com <sub>HCP</sub>	50	0.5				
K <sub>39</sub>	type_mom <sub>HCP</sub>	5	0.5				
<b>≺</b> 40	pre_birth_info <sub>HCP</sub>	50	0.5				
<b>K</b> 41	Wbirth_dev_det_HCP, det_risk_level_HCP	5	0.5				
K <sub>42</sub>	W <sub>det_risk_level_HCP</sub> , encourage_mom_HCP	5	0.5				
K <sub>43</sub>	W <sub>det_risk_level_HCP</sub> , calm_dad_HCP	5	0.5				
K <sub>44</sub>	Wirr_birth_weight_HCP, det_underw_HCP	5	0.5				
K <sub>45</sub>	W <sub>det_underw_HCP</sub> , refer_mom_ther_HCP	5	0.5				
K <sub>46</sub>	$\mathbf{W}_{det\_underw\_HCP}$ , teach_dad_sup_mom_HCP	5	0.5				
K <sub>47</sub>	W <sub>baby_born_HCP</sub> , type_com_HCP	5	0.5				
K <sub>48</sub>	$W_{type mom HCP, pre birth info HCP}$	5	0.5				

nature. An example can be a state *X* which gets activated after a certain period of time, and show the behavior through **alogistic** function. In this case, a modeler can use **step** functions to reflect the period along with the alogistic function, with different impact weights for both functions (where the sum of impact weights should be 1). Parameters contain the value for the parameters used with respect to a combination function during the simulation, which is also addressed in the literature (Treur, 2019). Please note, parameters may vary as per combination function used for a state. The simulation environment takes input with respect to

Role Matrix for Worst Case (a) for  $\boldsymbol{iv}$  – Initial Values.

	ms - speed factors	1
X <sub>1</sub>	type_mom	1
X <sub>2</sub>	artificiality_birth	1
X <sub>3</sub>	epidural_used	1
X <sub>4</sub>	deliv_baby	0.2
X <sub>5</sub>	baby_born	0.1
X <sub>6</sub>	MPPD	0.2
X <sub>7</sub>	PPPD	1
X <sub>8</sub>	kid_devel	1
Х <sub>9</sub>	pre_birth_info	0.1
X <sub>10</sub>	com_sup_hcp	0.1
X <sub>11</sub>	fat_ask_sup_com	0.3
X <sub>12</sub>	fat_rec_sup_com	0.1
X <sub>13</sub>	post_info_com_par	0.1
X <sub>14</sub>	refer_therapist	0.3
X <sub>15</sub>	mental_sup	0.1
X <sub>16</sub>	acknowl_fat	0.1
X <sub>17</sub>	age	0
X <sub>18</sub>	riskiness	0.5
X <sub>19</sub>	dilation_mom	1
X <sub>20</sub>	premature_birth	0
X <sub>21</sub>	type_com	1
X <sub>22</sub>	retention	1
X <sub>23</sub>	engaged	1
X <sub>24</sub>	stress	0.4
X <sub>25</sub>	birth_dev	1
X <sub>26</sub>	fear_level	1
X <sub>27</sub>	desire_sup	1
X <sub>28</sub>	ask_sup	0.2
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	1
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	1
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	0.1
X <sub>32</sub>	calm_dad <sub>HCP</sub>	0.1
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	1
X <sub>34</sub>	det_underw <sub>HCP</sub>	1
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	0.3
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	0.1
X <sub>37</sub>	baby_born <sub>HCP</sub>	1
X <sub>38</sub>	type_com <sub>HCP</sub>	1
X <sub>39</sub>	type_mom <sub>HCP</sub>	1
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	1
X <sub>41</sub>	$\boldsymbol{W}_{birth\_dev\_det\_HCP,det\_risk\_level\_HCP}$	0
X <sub>42</sub>	W <sub>det_risk_level_HCP</sub> , encourage_mom_HCP	0
X <sub>43</sub>	W <sub>det_risk_level_HCP</sub> , calm_dad_HCP	0
X <sub>44</sub>	$\mathbf{W}_{irr\_birth\_weight\_HCP}$ , det_underw_HCP	0
X <sub>45</sub>	$W_{det\_underw\_HCP, refer\_mom\_ther\_HCP}$	0
X <sub>46</sub>	W <sub>det_underw_HCP</sub> , teach_dad_sup_mom_HCP	0
X <sub>47</sub>	Wbaby_born_HCP, type_com_HCP	0
X <sub>48</sub>	W <sub>type_mom_HCP</sub> , pre_birth_info_HCP	0

# Table 17

Role Matrix for Worst Case (a) for ms – Speed Factors.

	iv - initial values	1
X <sub>1</sub>	type_mom	0
X <sub>2</sub>	artificiality_birth	0
X <sub>3</sub>	epidural_used	0
X <sub>4</sub>	deliv_baby	0
X <sub>5</sub>	baby_born	0
X <sub>6</sub>	MPPD	0.13
X <sub>7</sub>	PPPD	0
X <sub>8</sub>	kid_devel	0
X <sub>9</sub>	pre_birth_info	0
X <sub>10</sub>	com_sup_hcp	0
X <sub>11</sub>	fat_ask_sup_com	0
X <sub>12</sub>	fat_rec_sup_com	0
X <sub>13</sub>	post_info_com_par	0
X <sub>14</sub>	refer_therapist	0
X <sub>15</sub>	mental_sup	0
X <sub>16</sub>	acknowl_fat	0
X <sub>17</sub>	age	1
X <sub>18</sub>	riskiness	0
X <sub>19</sub>	dilation_mom	0.2
X <sub>20</sub>	premature_birth	1
X <sub>21</sub>	type_com	0
X <sub>22</sub>	retention	0
X <sub>23</sub>	engaged	0
X <sub>24</sub>	stress	0
X <sub>25</sub>	birth dev	0
X <sub>26</sub>	– fear level	0
X <sub>27</sub>	desire sup	0
X <sub>28</sub>	ask sup	0
X <sub>20</sub>	birth dev det <sub>HCP</sub>	0
X <sub>20</sub>	det risk leveluce	0
X <sub>21</sub>	encourage momuce	0
Xan	calm daduce	0
X22	irr birth weight <sub>uce</sub>	0
X <sub>24</sub>	det underw <sub>HCP</sub>	0
X25	refer mom there	0
X26	teach dad sup momun	0
X <sub>27</sub>	baby bornuce	0
X		0
X <sub>20</sub>	type momuce	0
X <sub>40</sub>	pre hirth inform	0
X40	Which does does not be a series	0
X	Dirth_dev_det_HCP, det_risk_level_HCP	0
X	•• det_risk_level_HCP, encourage_mom_HCP	0
v 43	<pre>v det_risk_level_HCP, calm_dad_HCP </pre>	0
X	<pre> • irr_birth_weight_HCP, det_underw_HCP W/ .</pre>	0
<b>X</b>	<pre>•• det_underw_HCP, refer_mom_ther_HCP W/.</pre>	0
×46	<pre>v det_underw_HCP, teach_dad_sup_mom_HCP W/.</pre>	0
V47	<pre>v baby_born_HCP, type_com_HCP M/</pre>	0
^48	type_mom_HCP, pre_birth_info_HCP	0

Role Matrix for Case (b) for mb – Base Connectivity.

	mb - base connectivity	1	2	:	3	4	5	6	7	8	9	10	11 12
X <sub>1</sub>	type_mom	X <sub>1</sub>											
Х,	artificiality birth	X.,	X <sub>18</sub>										
X-	epidural used	x.											
x.	deliv baby	х.	Xio										
v	hahy horn	v	119										
^5 V	MARRO	∧4 V	v	v	v	V							
×6	IMPPD	A1	A2	A3	A5	A <sub>15</sub>							
X <sub>7</sub>	РРРО	X <sub>6</sub>	X <sub>10</sub>	X <sub>12</sub>	X <sub>15</sub>	X <sub>23</sub>	X <sub>24</sub>						
X <sub>8</sub>	imp_kid_devel	X <sub>7</sub>											
X <sub>9</sub>	pre_birth_info	X <sub>9</sub>	X <sub>40</sub>	X <sub>52</sub>									
X <sub>10</sub>	com_sup_hcp	X <sub>4</sub>	X <sub>9</sub>	X <sub>11</sub>	X <sub>24</sub>	X <sub>30</sub>	X <sub>32</sub>	X <sub>34</sub>	X <sub>36</sub>	X <sub>42</sub>	X <sub>44</sub>	X <sub>46</sub>	X <sub>48</sub>
X <sub>11</sub>	fat_ask_sup_com	X <sub>23</sub>	X <sub>28</sub>										
X <sub>12</sub>	fat_rec_sup_com	X <sub>10</sub>	X <sub>22</sub>	X <sub>24</sub>									
X <sub>13</sub>	post_info_com_par	X <sub>5</sub>	X <sub>20</sub>	X <sub>31</sub>	X <sub>32</sub>	X <sub>36</sub>	X <sub>43</sub>	X44	X <sub>48</sub>				
X14	refer therapist	X12	X25	X.7									
X.,	mental sun	X.,	X.,	X.,	X	Xar	Xac	Xer	X.,	X	X		
Y.,	acknowl fat	Y-14	Y	Y.,	¥	X	7130	145	1.44	1.47	7.40		
^16 V	acknowi_rat	∧9 V	A32	A36	A44	A48							
A17	age	^17 V	N.										
×18	riskiness	X5	X <sub>17</sub>										
X <sub>19</sub>	dilation_mom	X <sub>19</sub>											
X <sub>20</sub>	premature_birth	X <sub>20</sub>											
X <sub>21</sub>	type_com	X <sub>21</sub>	X <sub>38</sub>	X <sub>50</sub>									
X <sub>22</sub>	retention	X <sub>23</sub>	X <sub>24</sub>										
X <sub>23</sub>	engaged	X <sub>16</sub>											
X <sub>24</sub>	stress	X <sub>26</sub>											
X25	birth dev	X <sub>4</sub>	X <sub>18</sub>										
Xac	fear level	Xaa	Xaa	Xar									
X	desire sun	X	- 1/4										
N27	ack cup	26 V											
A28	ask_sup	A27	v										
X <sub>29</sub>	birtn_dev_det <sub>HCP</sub>	X4	X <sub>18</sub>										
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	X <sub>29</sub>											
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	X <sub>30</sub>											
X <sub>32</sub>	calm_dad <sub>HCP</sub>	X <sub>11</sub>	X <sub>30</sub>										
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	X5	X <sub>20</sub>										
X <sub>34</sub>	det_underw <sub>HCP</sub>	X <sub>33</sub>											
Xas	refer mom ther <sub>HCP</sub>	X34											
Xac	teach dad sup momure	X											
X	haby born	X-											
v	tuno com	v											
A38	type_com <sub>HCP</sub>	A37											
X <sub>39</sub>	type_mom <sub>HCP</sub>	X <sub>1</sub>											
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	X <sub>39</sub>											
X <sub>41</sub>	birth_dev_det <sub>AIC</sub>	X <sub>4</sub>	X <sub>18</sub>										
X <sub>42</sub>	det_risk_level <sub>AIC</sub>	X <sub>41</sub>											
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	X <sub>42</sub>											
X <sub>44</sub>	calm_dad <sub>AIC</sub>	X <sub>11</sub>	X <sub>42</sub>										
X <sub>45</sub>	irr_birth_weight <sub>AIC</sub>	X <sub>5</sub>	X <sub>20</sub>										
X46	det underwarc	Xas											
XAT	refer mom theraic	Xac											
X <sub>49</sub>	teach dad sup moment	Xac											
Xio	haby bornus	Xr											
Y	tune com	X.,											
A50	type_com <sub>AIC</sub>	A49											
A51	type_mom <sub>AIC</sub>	A1											
A <sub>52</sub>	pre_birth_into <sub>AIC</sub>	X <sub>51</sub>											
X <sub>53</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	X <sub>53</sub>											
X <sub>54</sub>	W_det_risk_level_HCP, encourage_mom_HCP	X <sub>54</sub>											
X <sub>55</sub>	W_det_risk_level_HCP, calm_dad_HCP	X <sub>55</sub>											
X <sub>56</sub>	Wirr_birth_weight_HCP, det_underw_HCP	X <sub>56</sub>											
X <sub>57</sub>	W_det_underw_HCP, refer_mom_ther_HCP	X <sub>57</sub>											
X <sub>58</sub>	W_det_underw_HCP, teach_dad_sup_mom_HCP	X <sub>58</sub>											
X <sub>59</sub>	Wbaby_born_HCP, type_com_HCP	X <sub>59</sub>											
X <sub>60</sub>	W <sub>type_mom_HCP</sub> , pre_birth info HCP	X <sub>60</sub>											
X <sub>61</sub>	Wbirth dev det AIC det risk level AIC	X <sub>61</sub>											
X <sub>62</sub>	Wdet risk level AIC encourses man AIC	X <sub>62</sub>											
Xca	Web size level_Arc, encourage_mom_Arc	Xca											
X	oet_risk_level_Ait, caim_dad_AIC	X											
Y	Inf_pirth_weight_AIC, det_underw_AIC	Y											
N65	<pre>** det_underw_AIC, refer_mom_ther_AIC \A/</pre>	A65											
A66	W det_underw_AIC, teach_dad_sup_mom_AIC	A66											
X <sub>67</sub>	Wbaby_born_AIC, type_com_AIC	X <sub>67</sub>											
X <sub>68</sub>	Wtype_mom_AIC, pre_birth_info_AIC	X <sub>68</sub>											
X <sub>69</sub>	Hencourage_mom_AIC	X <sub>75</sub>											
X <sub>70</sub>	H <sub>calm_dad_AIC</sub>	X <sub>75</sub>											
X <sub>71</sub>	H <sub>refer_mom_ther_AIC</sub>	X <sub>75</sub>											
X <sub>72</sub>	Hteach_dad_sup_mom_AIC	X <sub>75</sub>											
X <sub>73</sub>	H <sub>type com AIC</sub>	X <sub>75</sub>											
X74	Hare birth info AIC	X <sub>75</sub>											
X	con act AIC	Xar											
		- 15						-	-				

each state. Therefore, for simulation, we provide the state specification. For instance, each state Y will have.

- the speed of influence of the incoming states (termed as  $\eta_{\gamma}$ )
- initial value (iv<sub>Y</sub>)
- cfData ( $cf_Y$ )
- list of incoming connections to state Y (e.g., states  $X_1, X_2, ..., X_n$ )

• the connection weight of each incoming state (e.g., from state  $X_1, X_2, \dots, X_n$ )

This input is processed to generate the simulation output. For each state, this output is computed by the formula mentioned in equation (1).

Role Matrix for Case (b) for mcw - Connection Weights.

	ncw - connection weights	1	2	3	4	1 5		6	7 8	9	10	11	12
X1	type mom	1	-					<u> </u>					
X,	artificiality birth	1	-1										
Xa	epidural used	1											
Xa	deliv baby	1	1										
Xs	baby born	1											
X <sub>6</sub>	MPPD	0.25	0.25	0.25	0.25	-1							
X <sub>7</sub>	PPPD	1	-0.5	-0.5	-0.5	-0.5	1						
Xs	kid devel	1											
Xo	pre birth info	1	1	1									
X10	com sup hcp	1	1	1	-1	1	1	1	1	1 1		1 1	
X11	fat ask sup com	1	1	-	-	-	-		-				
X12	fat rec sup com	1	1	-1									
X.,	post info com par	1	1	1	1	1	1	1	1				
X.,	refer therapist	1	1	1	-	-	-						
X.r	mental sup	1	1	1	1	1	1	1	1	1 1			
X1c	acknowl fat	1	1	1	1	1							
X10	age	1		-	_	-							
X	riskiness	-1	1										
X10	dilation mom	1											
X	premature birth	1											
X	type com	1	1	1									
X-21	retention	2	-1										
Xaa	engaged	1	-										
X_3	cheaged	1											
V	hirth day	1	1										
X25	fear level	-1	1	1									
X	desire sun	1											
∧27 ∨	ask sup	1											
^28 V	dsk_sup	1	1										
∧ <sub>29</sub> ∨	dot_rick_lovel	ı v											
^30 V	det_fisk_level <sub>HOP</sub>	A53											
^31 V	encourage_mon <sub>HCP</sub>	1	v										
A32	calm_dade	1	A55										
X <sub>33</sub>	Irr_birtn_weignt <sub>HCP</sub>	1 V	2										
X <sub>34</sub>	det_underw <sub>HCP</sub>	A <sub>56</sub>											
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	X <sub>57</sub>											
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	X <sub>58</sub>											
X <sub>37</sub>	baby_born <sub>HCP</sub>	1											
X <sub>38</sub>	type_com <sub>HCP</sub>	X <sub>59</sub>											
X <sub>39</sub>	type_mom <sub>HCP</sub>	1											
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	X <sub>60</sub>											
X <sub>41</sub>	birth_dev_det <sub>AIC</sub>	1	1										
X <sub>42</sub>	det_risk_level <sub>AIC</sub>	X <sub>61</sub>											
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	X <sub>62</sub>											
X <sub>44</sub>	calm_dad <sub>AIC</sub>	1	Х <sub>63</sub>										
X <sub>45</sub>	irr_birth_weight <sub>AIC</sub>	1	2										
X <sub>46</sub>	det_underw <sub>AIC</sub>	X <sub>64</sub>											
X <sub>47</sub>	refer_mom_ther <sub>AIC</sub>	X <sub>65</sub>											
X <sub>48</sub>	teach_dad_sup_mom <sub>AIC</sub>	X <sub>66</sub>											
X <sub>49</sub>	baby_born <sub>AIC</sub>	1											
X <sub>50</sub>	type_com <sub>AIC</sub>	X <sub>67</sub>											
X <sub>51</sub>	type_mom <sub>AIC</sub>	1											
X <sub>52</sub>	pre_birth_info <sub>AIC</sub>	X <sub>68</sub>											
X <sub>53</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	1											
X <sub>54</sub>	W_det_risk_level_HCP, encourage_mom_HCP	1											
X <sub>55</sub>	W_det_risk_level_HCP, calm_dad_HCP	1											
X <sub>56</sub>	Wirr_birth_weight_HCP, det_underw_HCP	1											
X <sub>57</sub>	W_det_underw_HCP, refer_mom_ther_HCP	1											
X <sub>58</sub>	W_det_underw_HCP, teach_dad_sup_mom_HCP	1											
X <sub>59</sub>	Wbaby_born_HCP, type_com_HCP	1											
X <sub>60</sub>	W <sub>type_mom_HCP</sub> , pre_birth_info_HCP	1											
X <sub>61</sub>	Wbirth_dev_det_AIC, det_risk_level_AIC	1											
X <sub>62</sub>	Wdet_risk_level_AIC, encourage_mom_AIC	1											
X <sub>63</sub>	Wdet_risk_level_AIC, calm_dad_AIC	1											
X <sub>64</sub>	Wirr_birth_weight_AIC, det_underw_AIC	1											
X <sub>65</sub>	W_det_underw_AIC, refer_mom_ther_AIC	1											
X <sub>66</sub>	Wdet_underw_AIC, teach_dad_sup_mom_AIC	1											
X <sub>67</sub>	Wbaby_born_AIC, type_com_AIC	1											
X <sub>68</sub>	Wtype_mom_AIC, pre_birth_info_AIC	1											
X <sub>69</sub>	Hencourage_mom_AIC	1											
X <sub>70</sub>	H <sub>calm_dad_AIC</sub>	1											
X <sub>71</sub>	Hrefer mom ther AIC	1											
X <sub>72</sub>	H <sub>teach dad sup mom AIC</sub>	1											
X <sub>73</sub>	H <sub>type com AIC</sub>	1											
X74	Hore birth info AIC	1											
X75	con act AIC	1											
13					_								

Therefore, '*output*' is a matrix containing timestamps and values for all the states of a model with their respective timestamps. Therefore, *output* not only reflects the state value at a certain time, but it also provide reasoning for the causal interaction between the states, which can be viewed by different plotting methods. Built-in plot methods were used to

generate the simulation results of the designed model, which can be viewed in Appendix B.

Role Matrix for Case (b) for mcfw – Combination Function Weights.

mcfw	- combination function weights	1 Alogistic	2 Stoponco
Χ.	type mom	Alogistic	Steponce
X1 X2	artificiality birth	1	
Xa	epidural used	1	
X4	deliv_baby	1	
X <sub>5</sub>	baby_born	1	
X <sub>6</sub>	MPPD	1	
X <sub>7</sub>	PPPD	1	
X <sub>8</sub>	kid_devel	1	
X <sub>9</sub>	pre_birth_info	1	
X <sub>10</sub>	com_sup_hcp	1	
X <sub>11</sub>	fat_ask_sup_com	1	
X <sub>12</sub>	fat_rec_sup_com	1	
X <sub>13</sub>	post_info_com_par	1	
X <sub>14</sub>	refer_therapist	1	
X <sub>15</sub>	mental_sup	1	
X <sub>16</sub>	acknowl_fat	1	
Х <sub>17</sub>	age	1	
X <sub>18</sub>	riskiness	1	
X <sub>19</sub>	dilation_mom	1	
∧ <sub>20</sub>	type com	1	
A21 X	retention	1	
X <sub>22</sub>	engaged	1	
X24	stress	1	
X <sub>25</sub>	birth dev	1	
X <sub>26</sub>	fear level	1	
X <sub>27</sub>	desire_sup	1	
X <sub>28</sub>	ask_sup	1	
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	1	
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	1	
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	1	
X <sub>32</sub>	calm_dad <sub>HCP</sub>	1	
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	1	
X <sub>34</sub>	det_underw <sub>HCP</sub>	1	
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	1	
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	1	
X <sub>37</sub>	baby_born <sub>HCP</sub>	1	
X <sub>38</sub>	type_com <sub>HCP</sub>	1	
X <sub>39</sub>	type_mom <sub>HCP</sub>	1	
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	1	
×41	dot_rick_lovel	1	
×42 ×		1	
X43	calm_dad.us	1	
X45	irr birth weight	1	
XAG	det underwarc	1	
X47	refer_mom_ther <sub>AIC</sub>	1	
X48	teach_dad_sup_mom <sub>AIC</sub>	1	
X <sub>49</sub>	baby_born <sub>AIC</sub>	1	
X <sub>50</sub>	type_com <sub>AIC</sub>	1	
X <sub>51</sub>	type_mom <sub>AIC</sub>	1	
X <sub>52</sub>	pre_birth_info <sub>AIC</sub>	1	
X <sub>53</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	1	
X <sub>54</sub>	W <sub>det_risk_level_HCP</sub> , encourage_mom_HCP	1	
X <sub>55</sub>	W <sub>det_risk_level_HCP</sub> , calm_dad_HCP	1	
X <sub>56</sub>	Wirr_birth_weight_HCP, det_underw_HCP	1	
X <sub>57</sub>	W_det_underw_HCP, refer_mom_ther_HCP	1	
X <sub>58</sub>	W det_underw_HCP, teach_dad_sup_mom_HCP	1	
X <sub>59</sub>	W baby_born_HCP, type_com_HCP	1	
X <sub>60</sub>	Wtype_mom_HCP, pre_birth_info_HCP	1	
^61 ¥	<pre>birth_dev_det_AIC, det_risk_level_AIC W</pre>	1	
×62 ×62	w det_risk_level_AIC, encourage_mom_AIC	1	
X63	w det_risk_level_AIC, calm_dad_AIC	1	
X65	Welat updary: AIC rafes mem the MC	1	
Xee	W dat updarw AIC tooch dod over AIC	1	
X <sub>67</sub>	What horn AIC ture com AIC	1	
X <sub>68</sub>	Wtype mom AIC are birth info AIC	1	
X <sub>69</sub>	Hencourage mom AIC	1	
X <sub>70</sub>	H <sub>calm_dad_AIC</sub>	1	
X <sub>71</sub>	H <sub>refer_mom_ther_AIC</sub>	1	
X <sub>72</sub>	H <sub>teach_dad_sup_mom_AIC</sub>	1	
X <sub>73</sub>	H <sub>type_com_AIC</sub>	1	
X <sub>74</sub>	H <sub>pre_birth_info_AIC</sub>	1	
X <sub>75</sub>	con_act_AIC		1

# Table 21

Role Matrix for Case (b) for mcfp – Combination Function Parameters.

		1 ΔΙ	ngistic	2 Steponce		
	mcfp - combination function parameters	Steepness	Threshold	Start Time End Time		
X1	type mom	50	0.5			
X2	artificiality_birth	50	0.5			
X3	epidural_used	50	0.5			
$X_4$	deliv_baby	5	0.5			
X5	baby_born	50	0.5			
X <sub>6</sub>	MPPD	5	0.3			
X7	PPPD	5	0.5			
X <sub>8</sub>	kid_devel	5	0.5			
Х <sub>9</sub>	pre_birth_info	50	0.5			
X <sub>10</sub>	com_sup_hcp	0.5	6			
X <sub>11</sub>	fat_ask_sup_com	5	1			
X <sub>12</sub>	fat_rec_sup_com	5	0.5			
X <sub>13</sub>	post_info_com_par	5	4			
X <sub>14</sub>	refer_therapist	5	1			
X <sub>15</sub>	mental_sup	5	5			
X <sub>16</sub>	acknowl_fat	5	0.8			
X <sub>17</sub>	age	5	0.5			
X <sub>18</sub>	riskiness	50	0.5			
X <sub>19</sub>	dilation_mom	2.8	0			
X <sub>20</sub>	premature_birth	5	0.5			
X <sub>21</sub>	type_com	5	0.1			
X <sub>22</sub>	retention	5	0.3			
X <sub>23</sub>	engaged	5	0.5			
X <sub>24</sub>	stress	5	0.5			
X <sub>25</sub>	birth_dev	50	1			
X <sub>26</sub>	fear_level	5	1			
X <sub>27</sub>	desire_sup	5	0.3			
X <sub>28</sub>	ask_sup	5	0.2			
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	5	1			
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	5	0.5			
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	5	0.5			
X <sub>32</sub>	calm_dad <sub>HCP</sub>	50	0.7			
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	5	1			
X <sub>34</sub>	det_underw <sub>HCP</sub>	5	0.5			
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	50	0.5			
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	50	0.7			
X <sub>37</sub>	baby_born <sub>HCP</sub>	5	0.5			
X <sub>38</sub>	type_com <sub>HCP</sub>	50	0.5			
X <sub>39</sub>	type_mom <sub>HCP</sub>	5	0.5			
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	50	0.5			
X <sub>41</sub>	birth_dev_det <sub>AIC</sub>	5	1			
X <sub>42</sub>	det_risk_level <sub>AIC</sub>	5	0.5			
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	5	0.5			
X <sub>44</sub>	calm_dad <sub>AIC</sub>	50	0.7			
X <sub>45</sub>	irr_birth_weight <sub>AIC</sub>	5	1			
X <sub>46</sub>	det_underw <sub>AIC</sub>	5	0.5			
X <sub>47</sub>	refer_mom_ther <sub>AIC</sub>	50	0.5			
X <sub>48</sub>	teach_dad_sup_mom <sub>AIC</sub>	50	0.7			
X <sub>49</sub>	baby_born <sub>AIC</sub>	5	0.5			
X <sub>50</sub>	type_com <sub>AIC</sub>	50	0.5			
X <sub>51</sub>	type_mom <sub>AIC</sub>	5	0.5			
X <sub>52</sub>	pre_birth_info <sub>AIC</sub>	50	0.5			
X <sub>53</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	5	0.5			
X <sub>54</sub>	Wdet_risk_level_HCP, encourage_mom_HCP	5	0.5			
X <sub>55</sub>	W det_risk_level_HCP, calm_dad_HCP	5	0.5			
X <sub>56</sub>	Wirr_birth_weight_HCP, det_underw_HCP	5	0.5			
A <sub>57</sub>	W det_underw_HCP, refer_mom_ther_HCP	5	0.5			
X <sub>58</sub>	W det_underw_HCP, teach_dad_sup_mom_HCP	5	0.5			
×59	W baby_born_HCP, type_com_HCP	5	0.5			
∧ <sub>60</sub>	VV type_mom_HCP, pre_birth_info_HCP	5	0.5			
^61	<pre>vv birth_dev_det_AIC, det_risk_level_AIC</pre>	5	0.5			
X-	<pre>v det_risk_level_AIC, encourage_mom_AIC W</pre>	5	0.5			
A63	<pre>vv det_risk_level_AIC, calm_dad_AIC vv det_risk_level_AIC, calm_dad_AIC</pre>	5	0.5			
X	Wirr_birth_weight_AIC, det_underw_AIC	5	0.5			
X	det_underw_AIC, refer_mom_ther_AIC	5	0.5			
X	<pre>v det_underw_AIC, teach_dad_sup_mom_AIC W.steachersteache</pre>	5	0.5			
Xeo	w baby_born_AIC, type_com_AIC	5	0.5			
X	++ type_mom_Aic, pre_birth_info_AiC	5	0.5			
X70	Hencourage_mom_Arc	5	0.5			
X7.	Herefore more those AIC	5	0.5			
X72	Hteach dad cup mar AlC	5	0.5			
X72		5	0.5			
X74	Hore birth info AIC	5	0.5			
-74	· pre_brith_mo_Arc		0.5			

# 8. Discussion and conclusion

This study presents adaptive computational network models covering (shared) mental models of the father and healthcare practitioner, which illustrates how they can communicate during childbirth. These models are designed using multidisciplinary literature. Therefore, first, the benefits of the HCP having a mental model for communication is presented. Then it shows the utility of a Virtual Safety Coach (AIC)

Role Matrix for Case (b) for ms – Speed Factors.

	ms - speed factors	1
X1	type_mom	1
X <sub>2</sub>	artificiality_birth	1
X3	epidural_used	1
X4	deliv_baby	0.2
X <sub>5</sub>	baby_born	0.1
X <sub>6</sub>	MPPD	0.2
X <sub>7</sub>	PPPD	1
X <sub>8</sub>	kid_devel	1
X <sub>9</sub>	pre_birth_info	0.1
X <sub>10</sub>	com_sup_hcp	0.1
X <sub>11</sub>	fat_ask_sup_com	0.3
X <sub>12</sub>	fat_rec_sup_com	0.1
X <sub>13</sub>	post_info_com_par	0.1
X <sub>14</sub>	refer_therapist	0.3
X15	mental_sup	0.1
X <sub>16</sub>	acknowl_fat	0.1
X <sub>17</sub>	age	0
X <sub>18</sub>	riskiness	0.5
X <sub>19</sub>	dilation_mom	1
X <sub>20</sub>	premature_birth	0
X <sub>21</sub>	type_com	1
X <sub>22</sub>	retention	1
X <sub>23</sub>	engaged	1
X <sub>24</sub>	stress	0.4
X25	birth dev	1
X25	fear level	1
X <sub>27</sub>	desire sup	1
X	ask sup	0.2
X 20	birth dev detuce	1
X29	det risk levelue	1
X30	encourage momune	0.1
X	calm_daducs	0.1
X32	irr birth weighture	1
X.	det underwurg	1
X34 X35	refer mom therum	03
X	teach dad sup momum	0.1
X <sub>36</sub>	haby bornus	1
X.,	type comuse	1
×38		1
X <sub>39</sub>	pre birth inform	1
×40	birth day det	1
X41 X	det risk level	1
X <sub>42</sub>		X
X43	calm_dadua	X
X44 X	irr birth weight	1
X45	det underwiss	1
X46	refer mom therwa	X
X47	teach dad sup mom	X-1 X-1
×48	haby born	1
×49	type com	Y
^50 V	type_com <sub>AIC</sub>	1
X	pre birth info	х
X52	White day de lice d'a lice	0
X 53	Water sight land LICD and the sight sight sight lice and	0
X	<pre>det_risk_level_HCP, encourage_mom_HCP</pre>	Ŭ
155	W	0
Xee	W det_risk_level_HCP, calm_dad_HCP	0
X <sub>56</sub> X	W det_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, det_underw_HCP	0 0
X <sub>56</sub> X <sub>57</sub> X	W det_risk_level_HCP, calm_dad_HCP W irr_birth_weight_HCP, det_underw_HCP W det_underw_HCP, refer_mom_ther_HCP	0 0 0
X <sub>56</sub> X <sub>57</sub> X <sub>58</sub> X <sub>58</sub>	W det_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, det_underw_HCP W det_underw_HCP, refer_mom_ther_HCP W det_underw_HCP, teach_dad_sup_mom_HCP	0 0 0 0
X <sub>56</sub> X <sub>57</sub> X <sub>58</sub> X <sub>59</sub> X <sub>59</sub>	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, det_underw_HCP Wdet_underw_HCP, refer_mom_ther_HCP Wdet_underw_HCP, teach_dad_sup_mom_HCP Wbaby_born_HCP, type_com_HCP	0 0 0 0
X <sub>56</sub> X <sub>57</sub> X <sub>58</sub> X <sub>59</sub> X <sub>60</sub> X <sub>-1</sub>	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, det_underw_HCP Wdet_underw_HCP, refer_mom_ther_HCP Wdet_underw_HCP, teach_dad_sup_mom_HCP Wbaby_born_HCP, type_com_HCP Wtype_mom_HCP, pre_birth_info_HCP	0 0 0 0 0
X <sub>56</sub> X <sub>57</sub> X <sub>58</sub> X <sub>59</sub> X <sub>60</sub> X <sub>61</sub>	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_dad_HCP Wdet_underw_HCP, refer_mom_HCP Wdet_underw_HCP, teach_dad_sup_mom_HCP Wbaby_born_HCP, type_com_HCP Wtype_mom_HCP, pre_birth_info_HCP Wbirth_dev_det_AIC, det_risk_level_AIC	0 0 0 0 0 0
X <sub>56</sub> X <sub>57</sub> X <sub>58</sub> X <sub>59</sub> X <sub>60</sub> X <sub>61</sub> X <sub>62</sub> X <sub>62</sub>	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_dad_HCP Wdet_underw_HCP, refer_mom_ther_HCP Wdet_underw_HCP, retend_dad_sup_mom_HCP Wbaby_born_HCP, type_com_HCP Wtype_mom_HCP, pre_birth_info_HCP Wbirth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, encourage_mom_AIC	0 0 0 0 0 0 0
X <sub>56</sub> X <sub>57</sub> X <sub>58</sub> X <sub>59</sub> X <sub>60</sub> X <sub>61</sub> X <sub>62</sub> X <sub>63</sub> X <sub>5-</sub>	Wate_risk_level_HCP, calm_dad_HCP Wirr_bith_weight_HCP, calm_dad_HCP Wdet_underw_HCP, tet_underw_HCP Wdet_underw_HCP, tetach_dad_sup_mom_HCP Wbaby_born_HCP, type_com_HCP Wtype_mom_HCP, pre_birth_info_HCP Wbirth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, calm_ada_AIC Wdet_risk_level_AIC, calm_ada_AIC	0 0 0 0 0 0 0 0 0
$X_{56}$ $X_{57}$ $X_{58}$ $X_{59}$ $X_{60}$ $X_{61}$ $X_{62}$ $X_{63}$ $X_{64}$ $X_{57}$	Wdet_risk_level_HCP, calm_dad_HCP Wirr_bith_weight_HCP, calm_dad_HCP Wdet_underw_HCP, calm_derw_HCP Wdet_underw_HCP, refer_mom_ther_HCP Wbaby_born_HCP, type_com_HCP Wpaby_born_HCP, pre_bith_info_HCP Wbirth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, encourage_mom_AIC Wdet_risk_level_AIC, calm_dad_AIC Wirr_bith_weight_AIC, det_underw_AIC	
X56 X57 X58 X59 X60 X61 X62 X63 X64 X63 X64 X65 X65	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_dad_HCP Wdet_underw_HCP, refer_mom_ther_HCP Wdet_underw_HCP, reach_dad_sup_mom_HCP Wbaby_born_HCP, type_com_HCP Wtype_mom_HCP, pre_birth_info_HCP Wbirth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, encourage_mom_AIC Wdet_risk_level_AIC, calm_dad_AIC Wirr_birth_weight_AIC, det_underw_AIC Wdet_underw_AIC, refer_mom_ther_AIC	
X56 X57 X58 X59 X60 X61 X62 X63 X63 X64 X65 X66 X65 X66	Wate_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, det_underw_HCP Wdet_underw_HCP, feter_mom_ther_HCP Wate_underw_HCP, refer_mom_ther_HCP Wate_underw_HCP, tree_birth_info_HCP Whype_mom_HCP, pre_birth_info_HCP Wbirth_dew_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, calm_dad_AIC Wirr_birth_weight_AIC, det_underw_AIC Wdet_underw_AIC, refer_mom_ther_AIC Wdet_underw_AIC, refer_mom_ther_AIC Wdet_underw_AIC, refer_mom_AIC Wdet_underw_AIC, refer_mom_AIC	
X56 X57 X58 X60 X61 X62 X64 X64 X64 X65 X66 X65 X66 X67 X69 X69 X69 X69 X69 X69 X69 X69 X69 X69	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_dad_HCP Wdet_underw_HCP, refer_mom_HCP Wdet_underw_HCP, tefer_mom_HCP Wbaby_born_HCP, type_com_HCP Wbirth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, det_risk_level_AIC Wdet_risk_level_AIC, calm_dad_AIC Wirr_birth_weight_AIC, det_underw_AIC Wdet_underw_AIC, refer_mom_ther_AIC Wdet_underw_AIC, teach_dad_sup_mom_AIC Wdet_underw_AIC, teach_dad_sup_mom_AIC	
X56 X57 X58 X60 X61 X62 X63 X64 X64 X64 X65 X66 X67 X68 X67 X68 X67 X68	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_dad_HCP Wdet_underw_HCP, refer_mom_ther_HCP Wdet_underw_HCP, refer_mom_ther_HCP Wbaby_born_HCP, type_com_HCP Wbaby_born_HCP, type_com_HCP Wbirth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, encourage_mom_AIC Wdet_risk_level_AIC, encourage_mom_AIC Wdet_underw_AIC, calm_dad_AIC Wirr_birth_weight_AIC, det_underw_AIC Wdet_underw_AIC, refer_mom_ther_AIC Wdet_underw_AIC, type_com_AIC Wbaby_born_AIC, type_com_AIC Wtrpe_mom_AIC, type_com_AIC Wtrpe_mom_AIC, type_com_AIC Wtrpe_mom_AIC, type_com_AIC	
X56 X57 X58 X59 X60 X61 X62 X63 X64 X65 X66 X65 X66 X66 X65 X66 X69 X69 X70	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_dad_HCP Wdet_underw_HCP, cete_underw_HCP Wdet_underw_HCP, tetach_dad_sup_mom_HCP Wbaby_born_HCP, type_com_HCP Wjorth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, encourage_mom_AIC Wdet_risk_level_AIC, calm_dad_AIC Wdet_risk_level_AIC, calm_dad_AIC Wdet_underw_AIC, ceter_mom_ther_AIC Wdet_underw_AIC, tetach_dad_sup_mom_AIC Wdet_underw_AIC, type_com_AIC Wjorp_mom_AIC, type_com_AIC Witype_mom_AIC Hencourage_mom_AIC Hencourage_mom_AIC	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
X56 X57 X58 X59 X60 X61 X62 X63 X64 X65 X66 X65 X66 X66 X66 X66 X69 X70 X70	Wdet_risk_level_HCP, calm_dad_HCP Wirr_bith_weight_HCP, calm_dad_HCP Wdet_underw_HCP, calm_derw_HCP Wdet_underw_HCP, refer_mom_ther_HCP Wdet_underw_HCP, treach_dad_sup_mom_HCP Wbaby_born_HCP, trype_com_HCP Wbaby_born_HCP, pre_bith_info_HCP Wbirth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, calm_dad_AIC Wdet_risk_level_AIC, calm_dad_AIC Wirr_birth_weight_AIC, det_underw_AIC Wdet_underw_AIC, refer_mom_ther_AIC Wdet_underw_AIC, trype_com_AIC Wababy_born_AIC, trype_com_AIC Wababy_born_AIC, trype_com_AIC Wtype_mom_AIC, pre_birth_info_AIC Hencourage_mom_AIC H calm_dad_AIC	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
X56 X57 X58 X59 X60 X61 X62 X63 X64 X65 X66 X66 X66 X66 X66 X66 X69 X70 X71 X71	Wate_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_derw_HCP Wdet_underw_HCP, reter_mom_ther_HCP Wate_underw_HCP, teath_dad_sup_mom_HCP Wbaby_born_HCP, type_com_HCP Whype_mom_HCP, pre_birth_info_HCP Wbirth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, cath_dad_AIC Wirr_birth_weight_AIC, det_underw_AIC Wate_underw_AIC, reter_mom_ther_AIC Wdet_underw_AIC, reter_mom_ther_AIC Wdet_underw_AIC, tree_com_AIC Wate_underw_AIC, type_com_AIC Wippe_mom_AIC, pre_birth_info_AIC Hencourage_mom_AIC Hencourage_mom_AIC Herefer_mom_ther_AIC	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
X56 X57 X58 X59 X60 X61 X62 X63 X64 X65 X66 X66 X67 X66 X67 X67 X67 X67 X70 X71 X72 X72	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_dad_HCP Wdet_underw_HCP, det_underw_HCP Wdet_underw_HCP, refer_mom_ther_HCP Wbaby_born_HCP, type_com_HCP Wbirth_dew_det_ALC, det_risk_level_ALC Wdet_risk_level_ALC, cencourage_mom_ALC Wdet_risk_level_ALC, det_underw_ALC Wdet_risk_level_ALC, cet_underw_ALC Wdet_underw_ALC, refer_mom_ther_ALC Wdet_underw_ALC, refer_mom_ther_ALC Wdet_underw_ALC, refer_mom_ther_ALC Wdet_underw_ALC, refer_mom_ther_ALC Wdet_underw_ALC, refer_mom_ther_ALC Horemom_ALC, type_com_ALC Wtype_mom_ALC, type_com_ALC Hencourage_mom_ALC Hrefer_mom_ther_ALC Hrefer_mom_ther_ALC Hrefer_mom_ther_ALC	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
X56 X57 X58 X58 X60 X61 X62 X63 X64 X64 X65 X66 X66 X66 X66 X66 X69 X70 X71 X72 X73 X73 X73	Wdet_risk_level_HCP, calm_dad_HCP Wirr_birth_weight_HCP, calm_dad_HCP Wdet_underw_HCP, refer_mom_HCP Wdet_underw_HCP, refer_mom_HCP Wbaby_born_HCP, type_com_HCP Wbaby_born_HCP, type_com_HCP Wbirth_dev_det_AIC, det_risk_level_AIC Wdet_risk_level_AIC, calm_dad_AIC Widet_risk_level_AIC, calm_dad_AIC Wirr_birth_weight_AIC, det_underw_AIC Wdet_underw_AIC, refer_mom_ther_AIC Wdet_underw_AIC, teach_dad_sup_mom_AIC Wdet_underw_AIC, type_com_AIC Wdet_underw_AIC, type_com_AIC Wtpe_mom_AIC, type_com_AIC Hencourage_mom_AIC Hencourage_mom_AIC Hrefer_mom_ther_AIC Hteach_dad_sup_mom_AIC Hteach_dad_sup_mom_AIC Hteach_ift_for for for	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

# Table 23

Role Matrix for Case (b) for iv – Initial Values.

v	iv - initial values	1
×1 X-	artificiality birth	0
X <sub>2</sub>	enidural used	0
X	deliv baby	0
Xs	baby born	0
X <sub>6</sub>	MPPD	0.13
X <sub>7</sub>	PPPD	0
X <sub>8</sub>	kid_devel	0
X <sub>9</sub>	 pre_birth_info	0
X <sub>10</sub>	com_sup_hcp	0
X <sub>11</sub>	fat_ask_sup_com	0
X <sub>12</sub>	fat_rec_sup_com	0
X <sub>13</sub>	post_info_com_par	0
X <sub>14</sub>	refer_therapist	0
X <sub>15</sub>	mental_sup	0
X <sub>16</sub>	acknowl_fat	0
X <sub>17</sub>	age	1
X <sub>18</sub>	riskiness	0
X <sub>19</sub>	dilation_mom	0.2
X <sub>20</sub>	premature_birth	1
X <sub>21</sub>	type_com	0
X <sub>22</sub>	retention	0
X <sub>23</sub>	engaged	0
X <sub>24</sub>	stress	0
X <sub>25</sub>	birth_dev	0
X <sub>26</sub>	fear_level	0
X <sub>27</sub>	desire_sup	0
X <sub>28</sub>	ask_sup	0
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	0
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	0
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	0
X <sub>32</sub>	calm_dad <sub>HCP</sub>	0
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	0
X <sub>34</sub>	det_underw <sub>HCP</sub>	0
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	0
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	0
X <sub>37</sub>	baby_born <sub>HCP</sub>	0
X <sub>38</sub>	type_com <sub>HCP</sub>	0
X <sub>39</sub>	type_mom <sub>HCP</sub>	0
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	0
X <sub>41</sub>	birth_dev_det <sub>AIC</sub>	0
X <sub>42</sub>	det_risk_level <sub>AIC</sub>	0
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	0
X <sub>44</sub>	calm_dad <sub>AIC</sub>	0
X <sub>45</sub>	irr_birth_weight <sub>AIC</sub>	0
X <sub>46</sub>	det_underw <sub>AIC</sub>	0
X <sub>47</sub>	refer_mom_ther <sub>AIC</sub>	0
X <sub>48</sub>	teach_dad_sup_mom <sub>AIC</sub>	0
X <sub>49</sub>	baby_born <sub>AIC</sub>	0
X <sub>50</sub>	type_com <sub>AIC</sub>	0
X <sub>51</sub>	type_mom <sub>AIC</sub>	0
A <sub>52</sub>	pre_birth_inio <sub>Alc</sub>	0
^53 V	Vv birth_dev_det_HCP, det_risk_level_HCP	0
∧ <sub>54</sub>	V det_risk_level_HCP, encourage_mom_HCP	0
∧55 ∨	V det_risk_level_HCP, calm_dad_HCP	0
X	Wirr_birth_weight_HCP, det_underw_HCP	0
X	W det_underw_HCP, refer_mom_ther_HCP	0
X	We det_underw_HCP, teach_dad_sup_mom_HCP	0
Xca	W. Here Here to the here	0
Xca	With the transmission of t	1
Xca	Webs side level AIC assume a serie AIC	1
X <sub>62</sub>	Wdet sick lovel AIC colm dad AIC	1
Xea	Wirr birth weight AIC det underw AIC	1
X <sub>65</sub>	Wdet underw AIC refer mom ther AIC	1
X <sub>66</sub>	Wdet underw AIC teach dad sup mom AIC	1
X <sub>67</sub>	What horn AIC type com AIC	1
X <sub>68</sub>	Wtype mom AIC pre birth info AIC	1
X <sub>69</sub>	Hencourage mom AIC	0
X <sub>70</sub>	H <sub>calm</sub> dad AIC	0
X <sub>71</sub>	Hrefer mom ther AIC	0
X <sub>72</sub>	H <sub>teach_dad_sup_mom_AIC</sub>	0
X <sub>73</sub>	H <sub>type_com_AIC</sub>	0
X <sub>74</sub>	Hpre_birth_info_AIC	0
Xar	con act AIC	1

Role Matrix for Case (c) for mb - Base Connectivity.

	mb - base connectivity	1	2	3	4	5	6	5 7	۲ (	9		10	11	12
X1	type_mom	X <sub>1</sub>								•				
X <sub>2</sub>	artificiality_birth	X2	X <sub>18</sub>											
X3	epidural_used	X3												
X <sub>4</sub>	deliv_baby	X4	X <sub>19</sub>											
Xs	baby_born	X4												
X <sub>6</sub>	MPPD	X <sub>1</sub>	X2	X3	Xs	X15								
X7	PPPD	X <sub>6</sub>	X10	X12	X15	X23	X24							
X.	imp kid devel	X-2												
Xa	pre birth info	Xa	Xeo	Xc2										
Xio	com sup hcp	x.	Xo	X	X	Xaa	Xaa	Xa	Xxx	Xia	X.,	Xic	Xio	
¥	fat ask sup com	X	¥		1.24		1.32	1.34	7-36	***2		- 46	1.040	
¥	fat rec sup com	X	Y	Y.										
¥	post info com par	¥-	Y	Y	Y.,	¥	¥	¥	¥					
×13 ×	refer therapist	X	X20 X	X	/32	A36	743	744	748					
×14 X	mental sun	X13 X	X-5	Y.,	Yes	Y	¥	Y	Y.	Y.e.	X			
×15	acknowl fat	×14 ¥.	X.1	X	X32	X	A36	743	744	//4/	748			
X16 X	379	X	A32	A36	A44	A48								
^17 V	age	^17 V	×											
^18 V	diation was	0°	A17											
^19 V	promoture high	^19 V												
^20 V	time com	^20 V	×	~										
^21 ×	retention	^21 V	^38 V	A50										
^22	retention	^23	A24											
×23	engageo	×16												
×24	stress	×26	×.											
A25	birth_dev	×4	×18											
A26	rear_rever	^23	A24	A25										
A <sub>27</sub>	uesire_sup	A26												
X <sub>28</sub>	ask_sup	×27	X											
X <sub>29</sub>	birtn_dev_det <sub>HCP</sub>	X4	A18											
X <sub>30</sub>	aet_risk_level <sub>HCP</sub>	×29												
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	X <sub>30</sub>												
X <sub>32</sub>	calm_dad <sub>HCP</sub>	X <sub>11</sub>	X <sub>30</sub>											
X <sub>33</sub>	Irr_birth_weight <sub>HCP</sub>	X <sub>5</sub>	X <sub>20</sub>											
X <sub>34</sub>	det_underw <sub>HCP</sub>	X <sub>33</sub>												
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	X <sub>34</sub>												
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	X <sub>34</sub>												
X <sub>37</sub>	baby_born <sub>HCP</sub>	X <sub>5</sub>												
X <sub>38</sub>	type_com <sub>HCP</sub>	X <sub>37</sub>												
X <sub>39</sub>	type_mom <sub>HCP</sub>	X1												
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	X <sub>39</sub>												
X41	birth_dev_det <sub>AIC</sub>	X.4	X <sub>18</sub>											
X <sub>42</sub>	det_risk_level <sub>AIC</sub>	X41												
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	X <sub>42</sub>												
X <sub>44</sub>	calm_dad <sub>AIC</sub>	X <sub>11</sub>	X42											
X <sub>45</sub>	irr_birth_weight <sub>Aic</sub>	Xs	X <sub>20</sub>											
X46	det_underw <sub>AIC</sub>	X45												
X47	refer_mom_ther <sub>AIC</sub>	X46												
X <sub>48</sub>	teach_dad_sup_mom <sub>AIC</sub>	X46												
X <sub>49</sub>	baby_born <sub>AIC</sub>	X <sub>5</sub>												
X <sub>50</sub>	type_com <sub>AIC</sub>	X <sub>49</sub>												
X <sub>51</sub>	type_mom <sub>AIC</sub>	X1												
X <sub>52</sub>	pre_birth_info <sub>AIC</sub>	X <sub>51</sub>												
X <sub>53</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	X <sub>53</sub>												
X <sub>54</sub>	Wdet_risk_level_HCP, encourage_mom_HCP	X54												
X55	Wdet_risk_level_HCP, calm_dad_HCP	X <sub>55</sub>												
X <sub>56</sub>	Wirr_birth_weight_HCP, det_underw_HCP	X56												
X <sub>57</sub>	Wdet_underw_HCP, refer_mom_ther_HCP	X <sub>57</sub>												
X <sub>58</sub>	Wdet_underw_HCP, teach_dad_sup_mom_HCP	X <sub>58</sub>												
X <sub>59</sub>	Wbaby_born_HCP, type_com_HCP	X59												
×60	Wtype_mom_HCP, pre_birth_info_HCP	X <sub>60</sub>												
A61	W birth_dev_det_AIC, det_risk_level_AIC	A61												
×62	<pre>w det_risk_level_AIC, encourage_mom_AIC A/</pre>	A62												
×63	<pre>w det_risk_level_AIC, calm_dad_AIC </pre>	^63 V												
×64 X	irr_birth_weight_AIC, det_underw_AIC	X												
×65 X	•• det_underw_AIC, refer_mom_ther_AIC	X												
Xcz	uwt_underw_Atc, teach_dad_sup_mom_Atc	Xcz												
Xee	Winne men AlC are birth into the	Xco												
Xco	Ware birth info Alf are hint info	Xea												
X70	Wraim dad AlC acknowl for	X <sub>85</sub>												
X <sub>71</sub>	Wteach dad sup mon AlC acknowl fat	X <sub>84</sub>												
X <sub>72</sub>	Woalm dad AlC com sur hon	X <sub>86</sub>												
X <sub>73</sub>	Wteach dad sup mom AlC com sup hon	X <sub>87</sub>												
X74	Wealm dad AlC post info com par	X89												
X <sub>75</sub>	Wteach dad sup mom AIC post info com par	X <sub>90</sub>												
X <sub>76</sub>	Wencourage mom AIC post info com par	X <sub>88</sub>												
X77	Wrefer mom ther AIC refer therapist	X <sub>91</sub>												
X <sub>78</sub>	Wcalm_dad_AIC, mental_sup	X <sub>94</sub>												
X <sub>79</sub>	Wteach_dad_sup_mom_AIC, mental_sup	X <sub>95</sub>												
X <sub>80</sub>	Wencourage_mom_AIC.mental_sup	X <sub>92</sub>												
X <sub>81</sub>	Wrefer mom ther AIG mental sup	X <sub>93</sub>												
X <sub>82</sub>	Wtype com AIC type com	X <sub>96</sub>												
X <sub>83</sub>	monitor_pre_birth_info	X <sub>52</sub>	X9											
X <sub>84</sub>	monitor_acknowl_fat1	X48	X <sub>16</sub>											
X <sub>85</sub>	monitor_acknowl_fat <sub>2</sub>	X44	X <sub>16</sub>											
X <sub>86</sub>	monitor_com_sup_hcp	X44	X10											
X <sub>87</sub>	monitor_com_sup_hcp2	X <sub>48</sub>	X <sub>10</sub>											
X <sub>88</sub>	monitor_post_info_com_par1	X <sub>43</sub>	X <sub>13</sub>											
X <sub>89</sub>	monitor_post_info_com_par2	X44	X <sub>13</sub>											
X <sub>90</sub>	monitor_post_info_com_par <sub>3</sub>	X <sub>48</sub>	X <sub>13</sub>											
X <sub>91</sub>	monitor_refer_therapist	X47	X <sub>14</sub>											
X <sub>92</sub>	monitor_mental_sup1	X <sub>43</sub>	X15											
X <sub>93</sub>	monitor_mental_sup <sub>2</sub>	X47	X15											
X <sub>94</sub>	monitor_mental_sup <sub>3</sub>	X44	X15											
X <sub>95</sub>	monitor_mental_sup4	X <sub>48</sub>	X15											
Xor	monitor type com	X	Y.,											

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intervening after a given amount of time, to compensate for actions not being taken by the healthcare practitioner. This study also presents an advanced version of the Coach, illustrating a more complex system using monitoring for determining whether the Coach performs communication or not. Simulation results indicate that integrating the partners into the childbirth process and viewing them as active actors, as well as opening up communication lines between HCP and parents', aids in decreasing the risk of postpartum depression and in return ensuring positive child development. Moreover, both communication actions by AIC and HCP carry the same weight. This indicates that both are equally as effective in reaching the same end goal of having no risk of the father developing PPD. Role Matrix for Case (c) for mcw – Connection Weights.

		1	2	2	4	r		-		ol o	10		12
m	type mom	1	2	3	4	5	6	4	<u> </u>	8 9	1	11	12
1	artificiality birth	1	-1										
2	epidural used	1	-										
, 1	deliv baby	1	1										
5	baby_born	1											
5	MPPD	0.25	0.25	0.25 0	0.25 -	1							
,	PPPD	1	-0.5	-0.5 -	-0.5 -	0.5 1							
8	kid_devel	1											
9	pre_birth_info	1	1	X <sub>69</sub>								_	
10	com_sup_hcp	1	1	1 -	-1 :	1 1		1	1	1	X <sub>72</sub>	1	X <sub>73</sub>
11	fat_ask_sup_com	1	1	1									
12	nost info com par	1	1	1 1	1 .	1		v	Y				
13	refer therapist	1	1	X		- <u>-</u>	76	A74	A75				
15	mental sup	1	1	1 1	1 :	1 1		Xso	X78	X <sub>81</sub>	X79		
16	acknowl_fat	1	1	1	X <sub>70</sub> 3	X <sub>71</sub>							
17	age	1											
18	riskiness	-1	1										
19	dilation_mom	1											
20	premature_birth	1											
21	type_com	1	1	X <sub>82</sub>									
22	retention	2	-1										
23	engaged	1											
24	stress	1											
25	birth_dev	1	1										
26	desire sup	1	1	1									
27	ask sup	1											
20	birth dev deture	1	1										
30	det risk level <sub>HCP</sub>	X53											
31	encourage_mom <sub>HCP</sub>	X54											
32	calm_dad <sub>HCP</sub>	1	X <sub>55</sub>										
33	irr_birth_weight <sub>HCP</sub>	1	2										
34	det_underw <sub>HCP</sub>	X <sub>56</sub>											
35	refer_mom_ther <sub>HCP</sub>	X <sub>57</sub>											
36	teach_dad_sup_mom <sub>HCP</sub>	X <sub>58</sub>											
37	baby_born <sub>HCP</sub>	1											
18	type_com <sub>HCP</sub>	X <sub>59</sub>											
39	type_mom <sub>HCP</sub>	1											
40	pre_birth_info <sub>HCP</sub>	X <sub>60</sub>											
11	birth_dev_det <sub>AIC</sub>	1	1										
12	det_risk_level <sub>AIC</sub>	X <sub>61</sub>											
13	encourage_mom <sub>AIC</sub>	X <sub>62</sub>	v										
14	calm_dad <sub>AlC</sub>	1	7										
15	det underw	¥	2										
10	refer mom theraic	Xee											
**	teach dad sup momain	Xee											
49	baby_born <sub>AIC</sub>	1											
50	type_com <sub>AIC</sub>	X <sub>67</sub>											
51	type_mom <sub>AIC</sub>	1											
52	pre_birth_info <sub>AIC</sub>	X <sub>68</sub>											
53	Wbirth_dev_det_HCP, det_risk_level_HCP	1											
54	Wdet_risk_level_HCP, encourage_mom_HCP	1											
55	Wdet_risk_level_HCP, calm_dad_HCP	1											
56	Wirr_birth_weight_HCP, det_underw_HCP	1											
57	W det_underw_HCP, refer_mom_ther_HCP	1											
58	Whathy hore HCP ture cam HCP	1											
50	Without many HCP, are birth info HCP	1											
51	Wbirth dev det AIC, det risk level AIC	1											
62	Wdet_risk_level_AIC, encourage_mom_AIC	1											
53	W_det_risk_level_AIC, calm_dad_AIC	1											
54	Wirr_birth_weight_AIC, det_underw_AIC	1											
55	W_det_underw_AIC, refer_mom_ther_AIC	1											
56	W_det_underw_AIC, teach_dad_sup_mom_AIC	1											
57	w baby_born_AIC, type_com_AIC	1											
18	Ware block lafe AIC and Market AIC	1											
70	W calm dad AlC acknowl for	1											
71	Wteach dad sup mom AIC acknowl fat	1											
72	Wcalm_dad_AIC, com_sup_hcp	1											
73	Wteach_dad_sup_mom_AIC, com_sup_htp	1											
74	Wcalm_dad_AIC, post_info_com_par	1											
75	Wteach_dad_sup_mom_AIC, post_info_com_par	1											
76	Wencourage_mom_AIC, post_info_com_par	1											
77	Wrefer_mom_ther_AIC, refer_therapist	1											
78	W calm_dad_AIC, mental_sup	1											
79	W teach_dad_sup_mom_AIC, mental_sup	1											
80	encourage_mom_AIC, mental_sup	1											
32	Winne com AIC time com	1											
13	monitor_pre_birth_info	1	1										
34	monitor_acknowl fat	1	1										
35	monitor_acknowl_fat <sub>2</sub>	1	1										
36	monitor_com_sup_hcp1	1	1										
37	monitor_com_sup_hcp2	1	1										
38	monitor_post_info_com_par <sub>1</sub>	1	1										
39	monitor_post_info_com_par2	1	1										
90	monitor_post_info_com_par <sub>3</sub>	1	1										
91	monitor_refer_therapist	1	1										
92	monitor_mental_sup1	1	1										
93	monitor_mental_sup <sub>2</sub>	1	1										
34	monitor_mental_sup	1	1										
75 16	monitor type com	1	1										

r.

Role Matrix for Case (c) for **mcfw** – Combination Function Weights.

.

mcfw	<ul> <li>combination function weights</li> </ul>	Alogistic	Monitor
$X_1$	type_mom	1	
X <sub>2</sub>	artificiality_birth	1	
X <sub>3</sub>	epidural_used	1	
∧4 Xr	baby born	1	
X <sub>6</sub>	MPPD	1	
X7	PPPD	1	
×s	kid_devel	1	
×,,	pre_birth_info	1	
×10 X11	fat ask sup com	1	
X <sub>12</sub>	fat_rec_sup_com	1	
X <sub>13</sub>	post_info_com_par	1	
X <sub>14</sub>	refer_therapist	1	
X <sub>15</sub>	mental_sup	1	
X <sub>16</sub> X <sub>17</sub>	age	1	
X <sub>18</sub>	riskiness	1	
X <sub>19</sub>	dilation_mom	1	
×20	premature_birth	1	
X <sub>21</sub>	type_com	1	
X22 X23	engaged	1	
X24	stress	1	
X <sub>25</sub>	birth_dev	1	
×26	fear_level	1	
X <sub>27</sub>	desire_sup	1	
X28 X29	birth dev deture	1	
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	1	
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	1	
X <sub>32</sub>	calm_dad <sub>HCP</sub>	1	
X <sub>33</sub>	Irr_birth_weight <sub>HCP</sub>	1	
^34 Xar	refer mom therum	1	
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	1	
X <sub>37</sub>	baby_born <sub>HCP</sub>	1	
X <sub>38</sub>	type_com <sub>HCP</sub>	1	
×39	type_mom <sub>HCP</sub>	1	
×40 X41	birth dev detaic	1	
X42	det_risk_level <sub>AIC</sub>	1	
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	1	
×44	calm_dad <sub>AIC</sub>	1	
X <sub>45</sub>	irr_birth_weight <sub>AIC</sub>	1	
X46 X47	refer mom theraic	1	
X <sub>48</sub>	teach_dad_sup_mom <sub>AIC</sub>	1	
X49	baby_born <sub>AIC</sub>	1	
× <sub>so</sub>	type_com <sub>AIC</sub>	1	
X <sub>51</sub>	type_mom <sub>AIC</sub>	1	
A52 X53	Whith day dat HCP dat risk layel HCP	1	
X <sub>54</sub>	W <sub>det_risk_level_HCP</sub> , encourage_mom_HCP	1	
×ss	W_det_risk_level_HCP, calm_dad_HCP	1	
X <sub>56</sub>	Wirr_birth_weight_HCP, det_underw_HCP	1	
^57 Xee	W det_underw_HCP, refer_mom_ther_HCP	1	
X <sub>59</sub>	Wbaby_born_HCP, type_com_HCP	1	
×60	Wtype_mom_HCP, pre_birth_info_HCP	1	
X <sub>61</sub>	Wbirth_dev_det_AIC, det_risk_level_AIC	1	
X <sub>62</sub>	Wdet_risk_level_AIC, encourage_mom_AIC	1	
^63 X_14	Wine bisth weights AIC dat underen AIC	1	
X <sub>65</sub>	Wdet underw AIC, refer mom ther AIC	1	
X <sub>66</sub>	Wdet_underw_AIC, teach_dad_sup_mom_AIC	1	
X <sub>67</sub>	Wbaby_born_AIC, type_com_AIC	1	
X <sub>68</sub> X <sub>68</sub>	Wtype_mom_AIC, pre_birth_info_AIC	1	
X <sub>70</sub>	pre_birth_into_AIC, pre_birth_info     Wcalm dad AIC, acknowl fat	1	
X <sub>71</sub>	Wteach_dad_sup_mom_AIC, acknowl_fat	1	
X <sub>72</sub>	Wcalm_dad_AIC, com_sup_hcp	1	
X <sub>73</sub>	Wteach_dad_sup_mom_AIC, com_sup_hcp	1	
X <sub>74</sub> X <sub>77</sub>	Wcalm_dad_AIC, post_info_com_par	1	
X <sub>76</sub>	teacn_dad_sup_mom_AIC, post_info_com_par	1	
X <sub>77</sub>	Wrefer_mom_ther_AIC, refer_therapist	1	
X <sub>78</sub>	Wcalm_dad_AIC, mental_sup	1	
X <sub>79</sub>	Wteach_dad_sup_mom_AIC, mental_sup	1	
A80 Xe1	wencourage_mom_AIC, mental_sup	1	
X <sub>82</sub>	Wtype_com_AIC, type_com	1	
X <sub>83</sub>	monitor_pre_birth_info		1
X <sub>84</sub>	monitor_acknowl_fat1		1
X <sub>85</sub>	monitor_acknowl_fat2		1
^86 Xez	monitor_com_sup_hcp1		1
X88	monitor_post_info_com_par1		1
X <sub>89</sub>	monitor_post_info_com_par2		1
X <sub>90</sub>	monitor_post_info_com_par <sub>3</sub>		1
X <sub>91</sub>	monitor_refer_therapist		1
A92 X93	monitor mental sup		1
X <sub>94</sub>	monitor_mental_sup <sub>3</sub>		1
X <sub>95</sub>	monitor_mental_sup <sub>4</sub>		1
X <sub>96</sub>	monitor_type_com		1

# Table 27

Role Matrix for Case (c) for mcfp – Combination Function Parameters.

		1 Alogistic	2 Monitor
merp -	combination function parameters	Steepness Threshold	Threshold
91 G	artificiality birth	50 0.5	
3	epidural_used	50 0.5	
4	deliv_baby	5 0.5	
5	MPPD	5 0.3	
7	PPPD	5 0.5	
8	kid_devel	5 0.5	
9	pre_birth_info	50 0.5 0.5 6	
-10 -11	fat_ask_sup_com	5 1	
12	fat_rec_sup_com	5 0.5	
13	post_info_com_par refer_therapist	5 4	
15	mental_sup	5 5	
16	acknowl_fat	5 0.8	
17	age riskiness	5 0.5	
19	dilation_mom	2.8 0	
20	premature_birth	5 0.5	
21	type_com retention	5 0.1	
23	engaged	5 0.5	
24	stress	5 0.5	
25	birth_dev fear_level	5 1	
27	desire_sup	5 0.3	
28	ask_sup	5 0.2	
29	birth_dev_det <sub>HCP</sub> det_risk_level	5 1	
30	encourage_mom <sub>HCP</sub>	5 0.5	
32	calm_dad <sub>HCP</sub>	50 0.7	
33	irr_birth_weight <sub>HCP</sub>	5 1	
34	refer_mom_ther <sub>HCP</sub>	50 0.5	
36	teach_dad_sup_mom <sub>HCP</sub>	50 0.7	
37	baby_born <sub>HCP</sub>	5 0.5	
38	type_com <sub>HCP</sub>	5 0.5	
40	pre_birth_info <sub>HCP</sub>	50 0.5	
41	birth_dev_det <sub>AIC</sub>	5 1	
42	encourage mom	5 0.5	
44	calm_dad <sub>AIC</sub>	50 0.7	
45	irr_birth_weight <sub>Aic</sub>	5 1	
46	refer mom theraic	5 0.5	
48	teach_dad_sup_mom <sub>AIC</sub>	50 0.7	
49	baby_born <sub>AIC</sub>	5 0.5	
50	type_com <sub>AIC</sub>	5 0.5	
52	pre_birth_info <sub>AIC</sub>	50 0.5	
53	Wbirth_dev_det_HCP, det_risk_level_HCP	5 0.5	
55	Wdet_risk_level_HCP, calm_dad_HCP	5 0.5	
56	Wirr_birth_weight_HCP, det_underw_HCP	5 0.5	
57	W det_underw_HCP, refer_mom_ther_HCP	5 0.5	
59	Wbaby_born_HCP, type_com_HCP	5 0.5	
60	Wtype_mom_HCP, pre_birth_info_HCP	5 0.5	
61	Whith_dev_det_AIC, det_risk_level_AIC	5 0.5	
-62 -63	Wdet_risk_level_AIC, calm_dad_AIC	5 0.5	
64	Wirr_birth_weight_AIC, det_underw_AIC	5 0.5	
65	Wdet_underw_AIC, refer_mom_ther_AIC	5 0.5	
67	Wbaby_born_AIC, type_com_AIC	5 0.5	
68	Wtype_mom_AIC, pre_birth_info_AIC	5 0.5	
69	Wpre_birth_info_AIC, pre_birth_info	5 0.5 5 0.5	
71	Wteach_dad_sup_mom_AIC, acknowl_fat	5 0.5	
72	Wcalm_dad_AIC, com_sup_hcp	5 0.5	
73	Wreach_dad_sup_mom_AIC, com_sup_hcp	5 0.5 5 0.5	
75	Wteach_dad_sup_mom_AIC, post_info_com_par	5 0.5	
76	Wencourage_mom_AIC, post_info_com_par	5 0.5	
77	Wrefer_mom_ther_AIC, refer_therapist	5 0.5	
79	Wteach_dad_sup_mom_AIC, mental_sup	5 0.5	
80	Wencourage_mom_AIC, mental_sup	5 0.5	
81	Wrefer_mom_ther_AIC, mental_sup Wtype com AIC, type com	5 0.5	
83	monitor_pre_birth_info		0.6
84	monitor_acknowl_fat		0.6
85	monitor_acknowi_rat <sub>2</sub> monitor_com_sup_hcp <sub>1</sub>		0.6
87	monitor_com_sup_hcp2		0.6
88	monitor_post_info_com_par1		0.6
89 90	monitor_post_info_com_para		0.6
91	monitor_refer_therapist		0.6
92	monitor_mental_sup1		0.6
94	monitor_mental_sup <sub>3</sub>		0.6
95	monitor_mental_sup <sub>4</sub>		0.6
96	monitor_type_com		0.6

Role Matrix for Case (c) for **iv** – Initial Values.

	ms - speed factors	1
×1	type_mom	1
X <sub>2</sub>	artificiality_birth	1
^3 X.	deliv baby	0.2
Xs	baby born	0.1
× <sub>6</sub>	MPPD	0.2
X <sub>7</sub>	PPPD	1
X <sub>8</sub>	kid_devel	1
X <sub>9</sub> X <sub>10</sub>	com sup hcp	0.1
X10 X11	fat_ask_sup_com	0.3
×12	fat_rec_sup_com	0.1
X <sub>13</sub>	post_info_com_par	0.1
X <sub>14</sub>	refer_therapist	0.3
A15 X16	acknowl fat	0.1
X <sub>17</sub>	age	0
X <sub>18</sub>	riskiness	0.5
X <sub>19</sub>	dilation_mom	1
X <sub>20</sub> X <sub>24</sub>	type com	1
X <sub>22</sub>	retention	1
X <sub>23</sub>	engaged	1
X <sub>24</sub>	stress	0.4
X <sub>25</sub>	birth_dev fear level	1
A26 X27	desire sup	1
X <sub>28</sub>	ask_sup	0.2
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	1
Х <sub>30</sub>	det_risk_level <sub>HCP</sub>	1
^31 Xaa	calm_daduce	0.1
X <sub>32</sub> X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	1
X <sub>34</sub>	det_underw <sub>HCP</sub>	1
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	0.3
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	0.1
X <sub>37</sub> X <sub>38</sub>	type comuce	1
X <sub>39</sub>	type_mom <sub>HCP</sub>	1
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	1
X <sub>41</sub>	birth_dev_det <sub>AIC</sub>	0.33
X <sub>42</sub>	det_risk_level_AIC	0.33
X44	calm_dad <sub>AIC</sub>	0.033
X45	irr_birth_weight <sub>AIC</sub>	0.33
X <sub>46</sub>	det_underw <sub>AIC</sub>	0.33
X47 X48	teach dad sup momaic	0.033
X <sub>49</sub>	baby_born <sub>AIC</sub>	0.33
×50	type_com <sub>AIC</sub>	0.33
X <sub>51</sub>	type_mom <sub>AIC</sub>	0.33
A52 X53	Whith day det HCP det risk lavel HCP	0.33
X <sub>54</sub>	W <sub>det_risk_level_HCP</sub> , encourage_mom_HCP	0
X55	W_det_risk_level_HCP, calm_dad_HCP	0
X56 X57	Wirr_birth_weight_HCP, det_underw_HCP	0
X <sub>58</sub>	Wdet_underw_HCP, teach_dad_sup_mom_HCP	0
X <sub>59</sub>	Wbaby_born_HCP, type_com_HCP	0
Xeo	Wtype_mom_HCP, pre_birth_info_HCP	0
A61 X62	Wdat risk level AIC encourage mom AIC	0
X <sub>63</sub>	Wdet_risk_level_AIC, calm_dad_AIC	0
X <sub>64</sub>	Wirr_birth_weight_AIC, det_underw_AIC	0
X <sub>65</sub>	W det_underw_AIC, refer_mom_ther_AIC	0
X <sub>67</sub>	det_underw_AIC, teach_dad_sup_mom_AIC     Wbaby_born_AIC_type_com_AIC	0
X <sub>68</sub>	Wtype_mom_AIC, pre_birth_info_AIC	0
X <sub>69</sub>	Wpre_birth_info_AIC, pre_birth_info	0
X <sub>70</sub>	Wcalm_dad_AIC, acknowl_fat	0.5
X71 X72	Veteach_dad_sup_mom_AIC, acknowl_fat	0.5
X <sub>73</sub>	Wteach_dad_sup_mom_AIC, com_sup_hcp	0.5
X <sub>74</sub>	Wcalm_dad_AIC, post_info_com_par	0.5
X <sub>75</sub>	Wteach_dad_sup_mom_AIC, post_info_com_par	0.5
~76 X77	Wrefer mom ther AIC refer therapist	0.5
X <sub>78</sub>	Wcalm_dad_AIC, mental_sup	0.5
X <sub>79</sub>	W <sub>teach_dad_sup_mom_AIC</sub> , mental_sup	0.5
X <sub>80</sub>	Wencourage_mom_AIC, mental_sup	0.5
×82	Wtype_com_AIC, type_com	0.5
X <sub>83</sub>	monitor_pre_birth_info	0.5
X <sub>84</sub>	monitor_acknowl_fat1	0.5
∧85 X86	monitor com sup hcp.	0.5
X <sub>87</sub>	monitor_com_sup_hcp2	0.5
×ss	monitor_post_info_com_par1	0.5
X <sub>89</sub> X <sub>00</sub>	monitor_post_info_com_par2	0.5
X <sub>91</sub>	monitor_refer_therapist	0.5
X <sub>92</sub>	monitor_mental_sup1	0.5
Х <sub>93</sub> Х	monitor_mental_sup	0.5
X <sub>95</sub>	monitor_mental_sup <sub>4</sub>	0.5
X <sub>96</sub>	monitor_type_com	0.5

# Table 29

Role Matrix for Case (c) for ms – Speed Factors.

<u></u>	iv - initial values	1
X <sub>1</sub>	type_mom	0
^2 X-	epidural used	0
X	deliv baby	0
Xs	baby_born	0
× <sub>6</sub>	MPPD	0.13
X <sub>7</sub>	PPPD	0
X <sub>8</sub>	kid_devel	0
X <sub>9</sub>	pre_birth_info	0
×10 ×	com_sup_ncp fat_ask_sup_com	0
×11 ×12	fat_rec_sup_com	0
X <sub>13</sub>	post info com par	0
X <sub>14</sub>	refer_therapist	ο
X <sub>15</sub>	mental_sup	0
X <sub>16</sub>	acknowl_fat	0
X <sub>17</sub>	age	1
X <sub>18</sub>	riskiness	0
× <sub>19</sub>	dilation_mom	1
×20 ×21	type com	0
X <sub>22</sub>	retention	0
X23	engaged	0
X <sub>24</sub>	stress	ο
X <sub>25</sub>	birth_dev	0
X <sub>26</sub>	fear_level	0
X <sub>27</sub>	desire_sup	0
A28	ask_sup	0
×29 ×20	det risk levelues	0
X31	encourage momun	0
X <sub>32</sub>	calm_dad <sub>HCP</sub>	0
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	0
X <sub>34</sub>	det_underw <sub>HCP</sub>	0
X <sub>35</sub>	refer_mom_ther <sub>HCP</sub>	0
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	0
X <sub>37</sub>	baby_born <sub>HCP</sub>	0
X <sub>38</sub>	type_com <sub>HCP</sub>	0
^39 X40	pre birth infouce	0
X <sub>41</sub>	birth dev det <sub>AlC</sub>	0
X42	det_risk_level <sub>AIC</sub>	0
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	ο
X <sub>44</sub>	calm_dad <sub>AIC</sub>	0
X <sub>45</sub>	irr_birth_weight <sub>AIC</sub>	0
X <sub>46</sub>	det_underw <sub>AIC</sub>	0
X <sub>47</sub>	reter_mom_therAic	0
X48 X40	baby bornarc	0
X50	type com <sub>AIC</sub>	0
X <sub>51</sub>	type_mom <sub>AIC</sub>	0
X <sub>52</sub>	pre_birth_info <sub>AIC</sub>	0
X <sub>53</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	0
X <sub>54</sub>	W det_risk_level_HCP, encourage_mom_HCP	0
Xee	Wine birth unright UCD dat undarus UCD	0
X57	Wdet underw HCP, refer mom ther HCP	0
X <sub>58</sub>	W <sub>det_underw_HCP</sub> , teach_dad_sup_mom_HCP	ο
X <sub>59</sub>	Wbaby_born_HCP, type_com_HCP	0
X <sub>60</sub>	W <sub>type_mom_HCP</sub> , pre_birth_info_HCP	0
X <sub>61</sub>	Wbirth_dev_det_AIC, det_risk_level_AIC	1
A62	<pre>det_risk_level_AIC, encourage_mom_AIC</pre>	1
X <sub>64</sub>	Wirr birth weight AIC dat underw AIC	1
X <sub>65</sub>	Wdet_underw_AIC, refer_mom_ther_AIC	1
X <sub>66</sub>	Wdet_underw_AIC, teach_dad_sup_mom_AIC	1
X <sub>67</sub>	Wbaby_born_AIC, type_com_AIC	1
X <sub>68</sub>	W <sub>type_mom_AIC</sub> , pre_birth_info_AIC	1
A <sub>69</sub>	VV pre_birth_info_AIC, pre_birth_info	0
×70	vv calm_dad_AIC, acknowl_fat	0
X <sub>72</sub>	Calm dad AIC. com sup hep	0
X <sub>73</sub>	Wteach dad sup mom AIC, com sup hcp	0
X <sub>74</sub>	Wcalm_dad_AIC, post_info_com_par	0
X <sub>75</sub>	Wteach_dad_sup_mom_AIC, post_info_com_par	0
X <sub>76</sub>	Wencourage_mom_AIC, post_info_com_par	0
X <sub>77</sub>	Wrefer_mom_ther_AIC, refer_therapist	0
×78	VV calm_dad_AIC, mental_sup	0
A79 Xaa	V teach_dad_sup_mom_AIC, mental_sup	0
X <sub>81</sub>	Wrefer mom ther AIC, mental sup	0
X <sub>82</sub>	W <sub>type_com_AIC</sub> , type_com	0
X <sub>83</sub>	monitor_pre_birth_info	0
X <sub>84</sub>	monitor_acknowl_fat1	0
X <sub>85</sub>	monitor_acknowl_fat2	0
×86	monitor_com_sup_hcp1	0
X <sub>87</sub>	monitor_com_sup_ncp2	0
X89	monitor_post_info_com_para	0
X90	monitor_post_info_com_par <sub>3</sub>	0
X <sub>91</sub>	monitor_refer_therapist	0
X <sub>92</sub>	monitor_mental_sup1	0
X <sub>93</sub>	monitor_mental_sup <sub>2</sub>	0
X <sub>94</sub>	monitor_mental_sup <sub>3</sub>	0
Xoc	monitor_type_com	0

Role Matrix for Case (d) for mb – Base Connectivity.

	mb - base connectivity	1	2	3	8	4	5	6	7	8	9	10	11	12
X1	type_mom	X1												
X <sub>2</sub>	artificiality_birth	X <sub>2</sub>	X <sub>18</sub>											
X <sub>3</sub>	epidural_used	X <sub>3</sub>	v											
X4 V	deliv_baby	X4 V	X <sub>19</sub>											
^5 X-	MPPD	Λ <sub>4</sub> Χ.	X.,	х.	х.	X.c								
76 X7	PPPD	Xe	X10	X12	Х <sub>16</sub>	X15 X12	Xaa							
X <sub>8</sub>	imp kid devel	X <sub>7</sub>	7410	742	745	123	7124							
X.9	pre_birth_info	X <sub>9</sub>	X40	X <sub>52</sub>										
X <sub>10</sub>	com_sup_hcp	X4	X <sub>9</sub>	X <sub>11</sub>	X <sub>24</sub>	X <sub>30</sub>	X <sub>32</sub>	X <sub>34</sub>	X36	X42	X <sub>44</sub>	X <sub>46</sub>	X <sub>48</sub>	
X <sub>11</sub>	fat_ask_sup_com	X <sub>23</sub>	X <sub>28</sub>											
X <sub>12</sub>	fat_rec_sup_com	X <sub>10</sub>	X <sub>22</sub>	X <sub>24</sub>										
X <sub>13</sub>	post_info_com_par	Xs	X <sub>20</sub>	X <sub>31</sub>	X <sub>32</sub>	X <sub>36</sub>	X <sub>43</sub>	X44	X48					
X <sub>14</sub>	refer_therapist	X <sub>13</sub>	X <sub>35</sub>	X47	V	V	v	v	×	v	v			
Xic	acknowl fat	X14 X2	×21 X22	×31 X <sub>26</sub>	X.,	X35 X40	A36	A43	A44	A47	A48			
X15 X17	age	X17	7.32	A36	P44	P48								
X18	riskiness	Xs	X <sub>17</sub>											
X19	dilation_mom	X <sub>19</sub>												
X <sub>20</sub>	premature_birth	X <sub>20</sub>												
X <sub>21</sub>	type_com	X <sub>21</sub>	X <sub>38</sub>	X <sub>50</sub>										
X <sub>22</sub>	retention	X <sub>23</sub>	X <sub>24</sub>											
X <sub>23</sub>	engaged	X <sub>16</sub>												
A24	hirth day	A26	Y											
Xac	fear level	Xm	X18 X24	Xvr										
X17	desire sup	X25	24											
X28	ask_sup	X <sub>27</sub>												
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	X4	X <sub>18</sub>											
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	X <sub>29</sub>												
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	X <sub>30</sub>												
X <sub>32</sub>	calm_dad <sub>HCP</sub>	X <sub>11</sub>	X <sub>30</sub>											
×33	det underw	×5	A <sub>20</sub>											
×34 Xae	refer mom there	A33 X												
X <sub>36</sub>	teach_dad_sup_mom	X <sub>34</sub>												
X <sub>37</sub>	baby_born <sub>HCP</sub>	Xs												
X <sub>38</sub>	type_com <sub>HCP</sub>	X <sub>37</sub>												
X <sub>39</sub>	type_mom <sub>HCP</sub>	X1												
X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	X <sub>39</sub>												
X <sub>41</sub>	birth_dev_det <sub>AIC</sub>	X4	X <sub>18</sub>											
X <sub>42</sub>	det_risk_level <sub>AIC</sub>	X <sub>41</sub>												
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	X <sub>42</sub>	×											
X <sub>44</sub> X <sub>47</sub>	irr birth weightag	X11 Xr	X42 X30											
Xas	det underwar	Xas	720											
X47	refer_mom_therAIC	X46												
X <sub>48</sub>	teach_dad_sup_mom <sub>AIC</sub>	X <sub>46</sub>												
X <sub>49</sub>	baby_born <sub>AIC</sub>	X <sub>s</sub>												
X <sub>50</sub>	type_com <sub>AIC</sub>	X <sub>49</sub>												
X <sub>51</sub>	type_mom <sub>Aic</sub>	X1												
X <sub>52</sub>	pre_birth_info <sub>AIC</sub>	X <sub>51</sub>	v											
X53 X64	W birth_dev_det_HCP, det_risk_level_HCP	Xca	Xer											
X <sub>55</sub>	Wdet risk level HCP calm dad HCP	Xss	X <sub>63</sub>											
X <sub>56</sub>	Wirr_birth_weight_HCP, det_underw_HCP	X <sub>56</sub>	X <sub>64</sub>											
X57	W_det_underw_HCP, refer_mom_ther_HCP	X57	X <sub>65</sub>											
X <sub>58</sub>	W_det_underw_HCP, teach_dad_sup_mom_HCP	X <sub>58</sub>	X <sub>66</sub>											
X <sub>59</sub>	Wbaby_born_HCP, type_com_HCP	X <sub>59</sub>	X <sub>67</sub>											
X <sub>60</sub>	Wtype_mom_HCP, pre_birth_info_HCP	X <sub>60</sub>	X <sub>68</sub>											
X <sub>61</sub>	W birth_dev_det_AIC, det_risk_level_AIC	X <sub>61</sub>	X <sub>99</sub>											
X62	W det_risk_level_AIC, encourage_mom_AIC	X	X100											
Xea	Wirr birth weight AIC det undere AIC	Xsa	X101 X102											
X <sub>65</sub>	W <sub>det_underw_AIC</sub> , refer_mom_ther_AIC	X <sub>65</sub>	X <sub>103</sub>											
X <sub>66</sub>	W_det_underw_AIC, teach_dad_sup_mom_AIC	X <sub>66</sub>	X <sub>104</sub>											
X <sub>67</sub>	Wbaby_born_AIC, type_com_AIC	X <sub>67</sub>	X <sub>105</sub>											
X <sub>68</sub>	Wtype_mom_AIC, pre_birth_info_AIC	X <sub>68</sub>	X <sub>106</sub>											
X <sub>69</sub>	Wpre_birth_info_AIC, pre_birth_info	X <sub>83</sub>												
A70 X	w calm_dad_AIC, acknowl_fat	^85 X												
X72	Wealm dad AIC own sun hon	X86												
X <sub>73</sub>	Wteach_dad_sup_mom_AIC.com_sup_hcp	X <sub>87</sub>												
X <sub>74</sub>	Wcalm_dad_AIC, post_info_com_par	X <sub>89</sub>												
X <sub>75</sub>	Wteach_dad_sup_mom_AIC, post_info_com_par	X <sub>90</sub>												
X <sub>76</sub>	Wencourage_mom_AIC, post_info_com_par	X <sub>88</sub>												
A77 X 70	verefer_mom_ther_AIC, refer_therapist	A91 Xaa												
X78	Wteach dad up man all mental sup	Xas												
X80	Wencourage_mom_AIC, mental_sup	X <sub>92</sub>												
X <sub>81</sub>	Wrefer_mom_ther_AIC, mental_sup	X <sub>93</sub>												
X <sub>82</sub>	W <sub>type_com_AIC, type_com</sub>	X <sub>96</sub>												
X <sub>83</sub>	monitor_pre_birth_info	X <sub>52</sub>	X <sub>9</sub>											
X <sub>84</sub>	monitor_acknowl_fat1	X <sub>48</sub>	X <sub>16</sub>											
X85	monitor_acknowi_fat <sub>2</sub>	X44 Y	X <sub>16</sub>											
∧86 Xe7	monitor_com_sup_hcp	×44 X49	A10 X10											
X <sub>88</sub>	monitor_post_info_com_par1	X43	X <sub>13</sub>											
X <sub>89</sub>	monitor_post_info_com_par2	X44	X <sub>13</sub>											
X <sub>90</sub>	monitor_post_info_com_par <sub>3</sub>	X <sub>48</sub>	X <sub>13</sub>											
X <sub>91</sub>	monitor_refer_therapist	X <sub>47</sub>	X <sub>14</sub>											
X <sub>92</sub>	monitor_mental_sup1	X <sub>43</sub>	X <sub>15</sub>											
×93	monitor_mental_sup <sub>2</sub>	X <sub>47</sub>	X <sub>15</sub>											
Xac Xac	monitor mental sup	X44 X49	X15 X15											
X <sub>96</sub>	monitor_type_com	X50	X <sub>21</sub>											
X <sub>97</sub>	W <sub>W_AIC,W_HCP</sub>	X <sub>98</sub>												
X <sub>98</sub>	con_feedback	X <sub>98</sub>												
X <sub>99</sub>	Wbirth_dev_det_E, det_risk_level_E													
X <sub>100</sub>	W_det_risk_level_E, encourage_mom_E													
X <sub>101</sub>	W_det_risk_level_E, calm_dad_E													
×102	Wirr_birth_weight_E, det_underw_E													
A103	W det_underw_E, refer_mom_ther_E													
X <sub>105</sub>	Where born E, type com E													
X <sub>106</sub>	Wtype_mom_E, pre_birth info E													
X <sub>107</sub>	W <sub>W_E,W_AIC</sub>	X <sub>108</sub>												
X <sub>108</sub>	con feedforward	X108												

Role Matrix for Case (d) for mcw - Connection Weights.



Although the father is considered an actor, the mental model of the father was not included, as the AI Coach is a tool for HCP's and therefore, the father's internal model would have added no additional useful information to the simulations and in return, to the real-life application. However, in monitoring action of the safety coach, the willingness of the father to speak up alone, elicited a reaction in the mental model of the HCP. Therefore, promoting and applying a just safety culture into hospital organizations, where all parties involved feel welcome to speak up,

Role Matrix for Case (d) for **mcfw** – Combination Function Weights.

2

2

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X.upp-monIII </th <th>mcfw</th> <th><ul> <li>combination function weights</li> </ul></th> <th>Alogistic</th> <th>Monitor</th> <th>Steponce</th>	mcfw	<ul> <li>combination function weights</li> </ul>	Alogistic	Monitor	Steponce
X.artificality	×1	type_mom	1		
No.InterpretationInterpretationNo.InterpretationInterpretationNo.MPDInterpretationNo.MPDInterpretationNo.MathematicalInterpretationNo.InterpretationInterpret	X <sub>2</sub>	artificiality_birth	1		
X.BAD_BON_DEN1III <th< td=""><td>×3 ×4</td><td>deliv baby</td><td>1</td><td></td><td></td></th<>	×3 ×4	deliv baby	1		
X <sub>n</sub> MPDIII <td>X<sub>5</sub></td> <td>baby_born</td> <td>1</td> <td></td> <td></td>	X <sub>5</sub>	baby_born	1		
X <sub>1</sub> PPDIII <td>×<sub>6</sub></td> <td>MPPD</td> <td>1</td> <td></td> <td></td>	× <sub>6</sub>	MPPD	1		
X <sub>1</sub> id. devalII <th< td=""><td>×7</td><td>PPPD</td><td>1</td><td></td><td></td></th<>	×7	PPPD	1		
SolutionControl<	× <sub>8</sub>	kid_devel	1		
XnFig.ack.group.comII </td <td>A9 X10</td> <td>com sup hcp</td> <td>1</td> <td></td> <td></td>	A9 X10	com sup hcp	1		
X <sub>1</sub> Int_conjectII<	X <sub>11</sub>	fat_ask_sup_com	1		
X <sub>h</sub> pot_nfs_com_par11 </td <td>×12</td> <td>fat_rec_sup_com</td> <td>1</td> <td></td> <td></td>	×12	fat_rec_sup_com	1		
X <sub>h</sub> refer. therapitsII<	X <sub>13</sub>	post_info_com_par	1		
And And And And And And And 	X14	refer_therapist	1		
Ny	X <sub>15</sub>	acknowl fat	1		
Xn No 	X16 X17	age	1		
Xa.International stateInternational stateInternational stateXa.VUPL_COMIIIXa.VUPL_COMIIIXa.StatesII <td>X18</td> <td>riskiness</td> <td>1</td> <td></td> <td></td>	X18	riskiness	1		
X <sub>0</sub> premature_birthii </td <td>X<sub>19</sub></td> <td>dilation_mom</td> <td>1</td> <td></td> <td></td>	X <sub>19</sub>	dilation_mom	1		
X <sub>1</sub> VPP_comIII	×20	premature_birth	1		
CAD CAD CAD CAD 	X <sub>21</sub>	type_com	1		
XayaitemsitemsitemsitemsXayaitemsitems	×22 ×22	engaged	1		
X <sub>h</sub> birth_deviiiX <sub>h</sub> desire_supiiiX <sub>h</sub> desire_supiiiX <sub>h</sub> desire_supiiiX <sub>h</sub> desire_supiiiX <sub>h</sub> desire_supiiiX <sub>h</sub> desire_supiiiX <sub>h</sub> descurster_supiiiX <sub>h</sub> descurster_supiiiX <sub>h</sub> descurster_supiiiX <sub>h</sub> descurster_supiiiX <sub>h</sub> teach_desup_mom_opiiiX <sub>h</sub> teach_desup_mom_opiiiX <sub>h</sub> teach_desup_mom_opiiiX <sub>h</sub> teach_desupiiiX <sub>h</sub> teach_desupiii </td <td>X24</td> <td>stress</td> <td>1</td> <td></td> <td></td>	X24	stress	1		
X <sub>0</sub> for a [see]iiiiX <sub>0</sub> atk_supiiiiX <sub>0</sub> atk_supiiiiX <sub>0</sub> def_risk_lewsleeiiiiX <sub>0</sub> def_risk_lewsleeiiiiX <sub>0</sub> def_risk_lewsleeiiiiX <sub>0</sub> def_risk_lewsleeiiiiX <sub>0</sub> def_risk_lewsleeiiiiX <sub>0</sub> def_risk_lewsleeiiiiX <sub>0</sub> tepichingiiiiiX <sub>0</sub> tepichingiiiiiX <sub>0</sub> tepichingiiiiiiX <sub>0</sub> tepichingiiiiiiX <sub>0</sub> tepichingiiiiiiX <sub>0</sub> tepichingiiiiiiX <sub>0</sub> tepichingiiiiiiX <sub>0</sub> tepichingiiiiiiiX <sub>0</sub> tepichingiiiiiiiX <sub>0</sub> tepichingiiiiiiiX <sub>0</sub> tepichingiiiiiiiX <sub>0</sub> tepichingiiiiiiiX <sub>0</sub> tepichingi <td< td=""><td>X<sub>25</sub></td><td>birth_dev</td><td>1</td><td></td><td></td></td<>	X <sub>25</sub>	birth_dev	1		
X <sub>2</sub> desire_supiiiiiX <sub>2</sub> birth_dev_dettioniiiiiX <sub>2</sub> birth_dev_dettioniiiiiX <sub>1</sub> encourage_mommoniiiiiX <sub>1</sub> encourage_mommoniiiiiX <sub>1</sub> encourage_mommoniiiiiX <sub>1</sub> det_unitheniiiiiX <sub>1</sub> teach_det_sup_mommoniiiiiX <sub>1</sub> teach_det_sup_mommoniiiiiX <sub>1</sub> teach_det_sup_mommoniiiiiX <sub>1</sub> teach_det_sup_momoniiiiiX <sub>1</sub> teach_det_sup_momoniiiiiX <sub>1</sub> teach_det_sup_momoniiiiiX <sub>2</sub> teach_det_sup_momoniiiiiX <sub>2</sub> teach_det_sup_momoniiiiiX <sub>2</sub> teach_det_sup_momoniiiiiX <sub>2</sub> teach_det_sup_momoniiiiiX <sub>2</sub> teach_det_sup_momoniiiiiX <sub>2</sub> teach_det_sup_momoniiiiiX <sub>3</sub> teach_det_sup_momoniiiiiX <sub>3</sub> teach_det_sup_momonii	X <sub>26</sub>	fear_level	1		
XayMaxMa	X <sub>27</sub>	desire_sup	1		
No.No	×28	ask_sup	1		
X <sub>1</sub> encourage mormup1IIIX <sub>1</sub> irr_birt_weightup1irr irr irr irr X <sub>1</sub> irr irr irr 	X29 X20	det risk leveluce	1		
X <sub>10</sub> calm_dadaps1NNX <sub>10</sub> calm_dadaps1NNX <sub>10</sub> det_underwne1NNX <sub>10</sub> teach_dad_sup_morm1NNX <sub>10</sub> teach_dad_sup_morm1NNX <sub>10</sub> trach_dad_sup_morm1NNX <sub>10</sub> trach_dad_sup_morm1NNX <sub>10</sub> trach_dad_sup_morm1NNX <sub>10</sub> trach_dad_sup_morm1NNX <sub>10</sub> trach_dad_sup1NNX <sub>10</sub> trach_dad_sup1N <td< td=""><td>X31</td><td>encourage_mom<sub>HCP</sub></td><td>1</td><td></td><td></td></td<>	X31	encourage_mom <sub>HCP</sub>	1		
Xniff_bitsIIIXniff_bitsIIIXnrefer_mon_ther_moIIIXntabl_borneIIIXntabl_borneIIIXntype_commoIIIXntype_commoIIIXntype_commoIIIXntype_commoIIIXntype_commoIIIXntype_commoIIIXntype_commoIIIXntype_commoIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borneIIIXntabl_borne	X <sub>32</sub>	calm_dad <sub>HCP</sub>	1		
And BarterControl Control Control 	×33	irr_birth_weight <sub>HCP</sub>	1		
Char         Char <thchar< th="">         Char         Char         <thc< td=""><td>×34</td><td>det_underw<sub>HCP</sub></td><td>1</td><td></td><td></td></thc<></thchar<>	×34	det_underw <sub>HCP</sub>	1		
$T_{A}$ baby_control to the product of the product o	×35 X36	teach dad sup momuce	1		
XagYPRE_DOTING* TAGE1IXagpre_jirth_inforger trict_dev_deta_c1IXagetc.jith_dev_deta_c1IXagetc.jith_dev_deta_c1IXagetc.jith_dev_deta_c1IXagetc.jith_dev_deta_c1IXagetc.jith_dev_deta_c1IXagetc.jith_dev_deta_c1IXagetc.jith_info_c1IXagetc.jith_info_c1IXagtec.h_info_c	X <sub>37</sub>	baby_born <sub>HCP</sub>	1		
XayaYpie_morning- typie_morning- typie_morning- typie_tonomake1Interpie typie	X <sub>38</sub>	type_com <sub>HCP</sub>	1		
Xa0pre_bitb_infoger1Image of the sector of	X <sub>39</sub>	type_mom <sub>HCP</sub>	1		
A1Introduction base descriptionIIA20defunderwate constraints1IX40calm_dadac constraints1IX40calm_dadac constraints1IX40calm_dadac constraints1IX40baby_bornac constraints1IX40baby_bornac constraints1IX40baby_bornac constraints1IX40baby_bornac constraints1IX41type_constraints1IX42type_constraints1IX43Wart_int_well(int, wart_int_well(int)1IX44Wart_int_well(int, wart_int_well(int)1IX45Wart_int_well(int), wart_int, wart_int)1IX45Wart_int_well(int), wart_int, wart_int)1IX46Wart_int_well(int), wart_int, wart_int)1IX47Wart_int_well(int), wart_int, wart_int)1IX48Wart_int_well(int), wart_int, wart_int)1IX49Wart_int_well(int), wart_int, wart_int)1IX40Wart_int_well(int), wart_int, wart_int)1IX41Wart_int_well(int), wart_int, wart_int)1IX41Wart_int_well(int), wart_int, wart_int)1IX42Wart_int, wart_int, wart_int, wart_int)1IX43Wart_int, wart_int, wart_int, wart_int)1IX44Wart_int, wart_int, wart_int) <t< td=""><td>X<sub>40</sub></td><td>pre_birth_info<sub>HCP</sub></td><td>1</td><td></td><td></td></t<>	X <sub>40</sub>	pre_birth_info <sub>HCP</sub>	1		
$\lambda_{10}$ encourage encourage anomalaaa $\lambda_{14}$ calm_dadac (alm_dadac (black)11 $\lambda_{16}$ if $\lambda_{16}$ 11 $\lambda_{26}$ if $\lambda_{16}$ 11 $\lambda_{16}$ if $\lambda_{16}$ if $\lambda_{16}$ 1 $\lambda_{16}$ if $\lambda_{16}$ if $\lambda_{16}$ 1 $\lambda_{26}$ if $\lambda_{26}$ if $\lambda_{26}$ 1 $\lambda_{26}$ if $\lambda_{26}$ if $\lambda_{26}$ 1 $\lambda_{16}$ if $\lambda_{16}$ if $\lambda_{16}$ if $\lambda_{16}$ $\lambda_$	A41 X42	det risk levelug	1		
XangCalm_dada_c1ImageXangcalm_plat_ac_matches1ImageXangdet_underw_ac1ImageXangteach_dad_styp_nom_Ac1ImageXangbaby_born_Ac1ImageXangteach_dad_styp_nom_Ac1ImageXangtransfer<	X42 X43	encourage mom <sub>AlC</sub>	1		
Xa6irr_birl_weight_ac111Xa7irr_birl_weight_ac1irr irr irr irr irr irr irr 	X44	calm_dad <sub>AIC</sub>	1		
Xa0def_underwac1IIKa1teach_dd_sup_momac1IIXa0bab_bornac1IIXa0type_nomac1IIXa1type_nomac1IIXa1Warndawdar.Jack.Howl.Howl.Howl.Howl.Howl.Howl.Howl.Howl	X <sub>45</sub>	irr_birth_weight <sub>AIC</sub>	1		
X <sub>2</sub> refer_mom_ther <sub>Acc</sub> 1         I           X <sub>6</sub> teah_dd_sp_mom <sub>Acc</sub> 1         I           X <sub>6</sub> bab_born <sub>Ac</sub> 1         I           X <sub>6</sub> type_corn <sub>Ac</sub> 1         I           X <sub>6</sub> teac, tab, tab, tab, tab, tab, tab, tab, tab	X46	det_underwaic	1		
AusDetail publy_Domy_ac1IINoStype_nomac1IINoStype_nomac1IINoStype_nomac1IINaWark_action (d. et.) (d. et	X <sub>47</sub>	refer_mom_therAIC	1		
$ \begin{array}{c c c c c c } \hline lem l lem$	X48 X40	baby_bornes	1		
Xa.         type_bith_info.c.         1         1           Xa.         Watrit_dwadeLPC, det_Tik_level_PCP         1         1           Xa.         Watrit_dwadeLPC, det_Tik_level_PCP         1         1           Xa.         Watrit_dwadeLPC, det_Tik_level_PCP         1         1           Xa.         Wat_Lik_level_PC, det_Tik_LPCP         1         1           Xa.         Wat_Lik_LPC, det_	X <sub>50</sub>	type_com <sub>AIC</sub>	1		
$X_{22}$ pre_birth_info $\Delta_{24}$ 1interval $X_{33}$ Whith, $\exists_{34} \neq 1/\beta$ , $d_{34}$ , $d_{34} \in 1/\beta$ , $d_{34}$	X <sub>51</sub>	type_mom <sub>AIC</sub>	1		
Asa         Warrichlagewall, Hep, and probability         1         Instant           Mater, Link, award, Hep, and anger, mom, then         1         1         1           Xab         Water, Link, award, Hep, and anger, mom, then         1         1           Xab         Water, Link, award, Hep, and anger, mom, then         1         1           Xab         Water, Link, award, Hep, and anger, mom, then         1         1           Xab         Water, Link, award, Link, award, Hep, and Ander         1         1           Xab         Water, Link, award, Link, a	X <sub>52</sub>	pre_birth_info <sub>AIC</sub>	1		
Add         Water, inst. prod. LCP, on inclusing amon, LCP         I           X55         Ware, inst. prod. LCP, on inclusing amon, LCP         I           X57         Water, inst. prod. LCP, on inclusing amon, LCP         I           X58         Ware, inst. Prod. PC, Prod. Comm, LCP         I           X59         Water, inst. Prod. PC, Prod. Comm, LCP         I           X50         Water, inst. Prod. PC, Prod. Comm, LCP         I           X61         Water, inst. Prod. AC, memon amon, LCP         I           X62         Water, inst. Prod. AC, encourage, mon, AC         I           X63         Water, inst. Prod. AC, encourage, mon, AC         I           X64         Ware, Inst. Prod. AC, encourage, mon, AC         I           X65         Water, underw, AC, rest. Mater, Mater, Mater, AC         I           X66         Water, underw, AC, rest. Mater, Mater, Mater, AC         I           X67         Water, Underw, AC, rest. Mater, M	X <sub>53</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	1		
App         App <td>^54 Xcc</td> <td>Wdet_risk_level_HCP, encourage_mom_HCP Wdet_risk_level_HCP, calm_dad_HCP</td> <td>1</td> <td></td> <td></td>	^54 Xcc	Wdet_risk_level_HCP, encourage_mom_HCP Wdet_risk_level_HCP, calm_dad_HCP	1		
Xay         Wat:_underw_life.teak_dat_up_mom_life         1         1         1           Xay         Wat:_underw_life.teak_dat_up_mom_life         1         1         1           Xay         Wat:_underw_life.teak_dat_up_mom_life         1         1         1           Xay         Wat:_underw_life.true_life.ter         1         1         1           Xay         Wat:_underw_life.true_life.ter         1         1         1           Xay         Wat:_underw_life.ter         1         1         1           Xay         Wat:_underw_life.tat_underw_life         1         1         1           Xay         Wat:_underw_life.tat_underw_life.tatu         1         1 <td< td=""><td>X55 X56</td><td>Wirr birth weight HCP, det underw HCP</td><td>1</td><td></td><td></td></td<>	X55 X56	Wirr birth weight HCP, det underw HCP	1		
XagWater, underw. 140; tesch, dat. yag. nom. 14011XagWashy, Jonn, 140; type_nom, 14011XagWirpe_nom.140; type_nom, 140; 14111XagWater, 1at. 140; 142, 143, 140; 14211XagWater, 1at. 140; 144, 14411XagWater, 1at. 140; 144, 14411XagWater, 1at. 140; 144, 14411XagWater, 1at. 140; 144, 14411XagWater, 141, 140; 144, 144, 14411XagWater, 141, 140; 144, 144, 14411XagWater, 141, 144, 144, 144, 144, 14411XagWater, 141, 144, 144, 144, 144, 144, 14411XagWater, 141, 144, 144, 144, 144, 144, 144, 14	X57	W_det_underw_HCP, refer_mom_ther_HCP	1		
Xap         Wash_sort_InfC; type_trans_information         1           Xap         Wirt_netwistory me_thrin_information         1           Xap         Wash_netwistory me_thrin_information         1           Xap         Wash_netwistory me_thrin_information         1           Xap         Wash_netwistory Act, restangement, Act         <	×58	W_det_underw_HCP, teach_dad_sup_mom_HCP	1		
Ano         Winyge_mon_ICF: pre_int_info_ICF         I           Kai         Wint_info_Kai, Lice J.r., Site J.R	X <sub>59</sub>	Wbaby_born_HCP, type_com_HCP	1		
All         Matrix_able Value (Action (Actio) (Action (Actio) (Action (Actio) (Action (Action (Action (Action	×60 ×	Vtype_mom_HCP, pre_birth_info_HCP	1		
Xaps         Water	X <sub>62</sub>	Wdet risk level AIC encourage mom AIC	1		
XatWurp jush, weigh, AL at junderw, AL1IXatWat, junderw, AL (set and junderw, AL1IXatWat, junderw, AL (set and junderw, AL1IXatWat, junderw, AL (set and junderw, AL1IXatWishy, Jonn, AL (spe, Junder, Junder, AL1IXatWath, Junder, Junder, AL1IXatWath, Junder,	X <sub>63</sub>	Wdet_risk_level_AIC, calm_dad_AIC	1		
X65Wate_underw.Aft_refer_nom_ther_Aft1X66Wate_underw.Aft_refer_nom_ther_Aft1X67Wate_underw.Aft_refer_nom_ther_Aft1X67Wate_underw.Aft_refer_nom_thefAft1X68Wyre_born.Aft type_com.Aft1X69Ware_birth_info_Aft; pre_limth_infoAft1X60Wate_aft, deta_mont_lat1X71Wateaft, deta_mont_lat1X72Wateaft, deta_mont_lat1X73Wateaft, deta_mont_lat1X74Wateaft, deta_mont_lat1X75Wateaft, deta_mont_lat1X76Wateaft, deta_mont_lat1X77Wateaft, deta_mont_lat1X78Wateaft, deta_mont_lat1X79Wateaft, deta_mont_lath_com_par1X77Wateaft, deta_mont_lath_aft1X78Wateaft, deta_mont_lath_aft1X79Wateaft, deta_mont_lath_aft1X79Wateaft, deta_mont_lath_aft1X79Wateaft, deta_mont_lath_aft1X80Wateaft, deta_mont_lath_aft1X81Wateaft, deta_mont_lath_aft1X82Wyne_cont_lath_aft1X84monitor_aft1X84monitor_for_for_for_for1X85monitor_for_for_for_for1X86monitor_for_for_for_for_for1X87wyne_cont_lath_aft1X88monitor_for_for_for_for_for_for1X89monitor_for_for_for_for_for_for_for1 <td>X<sub>64</sub></td> <td>Wirr_birth_weight_AIC, det_underw_AIC</td> <td>1</td> <td></td> <td></td>	X <sub>64</sub>	Wirr_birth_weight_AIC, det_underw_AIC	1		
AndMater.underw.Aft. issall.datl.gop.mom.AftI $Z_{q7}$ Mosby_Dorn.Aft. iveemon.Aft1KailWopebrith.jond.City.enemon.Aft1XailWopebrith.jond.City.enemon.Aft1XailWopebrith.jond.Aft. prebrith.jond.Aft1XailWorebrith.jond.Aft. prebrith.jond.Aft1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond.aft.1XailWorebrith.jond.Aft. prebrith.jond.aft.1XailWorebrith.jond.Aft. prebrith.jond.aft.1XailWorebrith.jond.Aft. prebrith.jond.aft.1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWorebrith.jond.Aft. prebrith.jond1XailWordbrith.jond.Aft. prebrith.jond1XailWordbrith.jond.Aft. prebrith.jond.1XailWordbrith.jond.Aft.1XailWordbrith.j	X <sub>65</sub>	Wdet_underw_AIC, refer_mom_ther_AIC	1		
The Discrete Section (Discrete Section (Dis	A66 X	W det_underw_AIC, teach_dad_sup_mom_AIC	1		
XapWare_burth_one_ACC pre_burth_one1IXapWare_burth_one_ACC pre_burth_one1IXapWare_burth_one_ACC pre_burth_one1IXapWare_burth_one_ACC pre_burth_one1IXapWareburth_one_ACC com_Sup_hop1IXapWareburth_one_ACC com_Sup_hop1IXapWareburth_one_ACC com_Sup_hop1IXapWareburthoft_one_ACC com_Sup_hop1IXapWareburther_ACC com_Sup_hop1IXapWareburther_ACC com_Sup_hop1IXapWareburther_ACC com_Sup_hop1IXapWareburther_ACC comtal_sup1IXapWareburther_ACC metal_sup1IXapWareburther_ACC remetal_sup1IXapWareburther_ACC remetal_sup1IXapWareburther_ACC remetal_sup1IXapWareburther_ACC remetal_sup1IXapWareburther_ACC remetal_sup1IXapmonitor_pre_birth_info1IXapmonitor_com_Sup_hop1IXapmonitor_prest_info_com_pars1IXapmonitor_prest_info_com_pars1IXapmonitor_mental_sup1IXapmonitor_mental_sup1IXapmonitor_mental_sup1IXapmonitor_mental_sup1IXapWareburther_tomental_sup1 </td <td>X<sub>68</sub></td> <td>Wtype mom AIC pre birth info AIC</td> <td>1</td> <td></td> <td></td>	X <sub>68</sub>	Wtype mom AIC pre birth info AIC	1		
XnoWarm, died, Art., advance Late1IXn1Wisch, died, Lie, cam, Jaug, herp1IXn2Wisch, died, Jule, own, Alf., died, herp1IXn3Wisch, died, Jule, own, Alf., died, fung, own, Jule1IXn4Wisch, died, Jule, own, Jule, died, own, Jane1IXn5Wisch, died, Jule, own, Jule1IXn6Wisch, died, Jule, Jule, own, Jule1IXn7Wisch, died, Jule, Jule, own, Jule1IXn8Wisch, died, Jule, Jule, own, Jule1IXn8Wisch, died, Jule, Jule, Jule1IXn8Wisch, died, Jule, Jule, Jule1IXn8Wisch, died, Jule, Jule, Jule1IXn9Wisch, Jule, Jule, Jule1IXn9Wisch, Jule, Jule, Jule1IXn9Wisch, Jule, Jule, Jule1IXn9Wisch, Jule, Jule, Jule1IXn1Wisch, Jule, Jule, Jule1IXn2Wisch, Jule, Jule, Jule1IXn3monitor_post, Jule1IXn4monitor_post, Jule1IXn4monitor_post, Jule1IXn4monitor_post, Jule1IXn4monitor_post, Jule1IXn4monitor_post, Jule1IXn4monitor_post, Jule1IXn4monitor_mental_sup1IXn5monitor_mental_sup<	X <sub>69</sub>	Wpre_birth_info_AIC, pre_birth_info	1		
X1 X2Weesh_del_sup_mon_ALC_achows_het11X2Weinh_del_ALC_ann_sup_ALC_achows_het1IX3Weinh_del_ALC_ann_sup_ALC_achows_het1IX4Weinh_del_ALC_ann_sup_ALC_achows_het1IX5Weinh_del_ALC_post_info_com_par1IX6Weinh_del_ALC_post_info_com_par1IX7Weinh_del_ALC_achows_het1IX7Weinh_del_ALC_metral_sup1IX8Weinh_del_ALC_metral_sup1IX9Weinh_del_ALC_metral_sup1IX8Winsh_del_ALC_metral_sup1IX8monitor_acknows_fat1IX8monitor_acknows_fat1IX8monitor_acknows_fat1IX8monitor_acknows_fat1IX8monitor_acknows_fat1IX8monitor_post_info_com_pars1IX9monitor_post_info_com_pars1IX8monitor_post_info_com_pars1IX9monitor_mental_sup1IX9monitor_mental_sup1IX9monitor_mental_sup1IX9monitor_mental_sup1IX9monitor_mental_sup1IX9monitor_mental_sup1IX9monitor_mental_sup1IX9monitor_mental_sup1IX9monitor_mental_sup1I<	X70	Wcalm_dad_AIC, acknowl_fat	1		
Arg         Wain_data_Ait         Second Seco	X <sub>71</sub>	Wteach_dad_sup_mom_AIC, acknowl_fat	1		
7.9       ************************************	A72 X73	Wearth dad_AIC, com_sup_hcp	1		
NoteNoteNoteNote $X_{75}$ Weak_ddsup_pmon_Afc_post_info_com_par1 $X_{77}$ Weak_ddsup_pmon_Afc_post_info_com_par1 $X_{77}$ Weak_ddsup_mon_Afc_post_info_com_par1 $X_{78}$ Weak_ddsup_mon_Afc_mental_up1 $X_{79}$ Weak_ddsup_mon_Afc_mental_up1 $X_{80}$ Weak_ddsup_mon_Afc_mental_up1 $X_{81}$ Wreak_ddsup_mon_Afc_mental_up1 $X_{82}$ Wyse_ond_Afc_remetal_up1 $X_{84}$ monitor_acknowl_fat;1 $X_{86}$ monitor_acknowl_fat;1 $X_{87}$ monitor_acknowl_fat;1 $X_{80}$ monitor_post_info_com_par;1 $X_{80}$ monitor_post_info_com_par;1 $X_{80}$ monitor_mental_sup;1 $X_{80}$ monitor_mental_sup;1 $X_{80}$ monitor_mental_sup;1 $X_{80}$ monitor_mental_sup;1 $X_{81}$ monitor_mental_sup;1 $X_{82}$ monitor_mental_sup;1 $X_{84}$ monitor_mental_sup;1	×73 ×74	teacn_dad_sup_mom_AIC, com_sup_hcp     Wcalm dad AIC, post_info_com_nar	1		
X76       Wincourage_mon_Alic_post_info_com_par       1         X77       Winefer_mom_ther_Alic_test_intrapiat       1         X78       Winefer_mom_ther_Alic_test_intrapiat       1         X79       Winefer_mom_ther_Alic_test_intrapiat       1         X90       Winefer_mom_ther_Alic_mental_sup       1         X91       Winefer_mom_ther_Alic_mental_sup       1         X92       Winefer_mom_ther_Alic_mental_sup       1         X91       Winefer_mom_ther_Alic_mental_sup       1         X92       Winefer_mom_ther_Alic_mental_sup       1         X93       monitor_alichnowl_fatz       1         X94       monitor_alichnowl_fatz       1         X95       monitor_com_sup_hcp_       1         X96       monitor_post_info_com_pars       1         X97       monitor_montal_sup_1       1         X98       monitor_mental_sup_1       1         X90       monitor_mental_sup_1       1         X91       monitor_mental_sup_1       1         X92       monitor_mental_sup_1       1         X93       monitor_mental_sup_1       1         X94       monitor_mental_sup_1       1         X95       monitor_mental_sup_1       1 <td>X<sub>75</sub></td> <td>Wteach_dad_sup_mom_AIC, post_info_com_par</td> <td>1</td> <td></td> <td></td>	X <sub>75</sub>	Wteach_dad_sup_mom_AIC, post_info_com_par	1		
X77       Wirefar, mem. ther. ALC, refer_therapist       1         X89       Waint, add.A.C, memtal_sup       1         X80       Waint, add.A.C, memtal_sup       1         X80       Waint, add.A.C, memtal_sup       1         X80       Waint, add.A.C, memtal_sup       1         X81       Waint, add.A.C, memtal_sup       1         X82       Wipeg_com_ALC, repre_tom       1         X83       monitor_pre_birth_info       1         X84       monitor_acknowl_fatz       1         X85       monitor_com_sup_hcp1       1         X86       monitor_post_info_com_pars       1         X80       monitor_post_info_com_pars       1         X80       monitor_post_info_com_pars       1         X80       monitor_mental_sup1       1         X81       monitor_mental_sup2       1         X82       monitor_mental_sup3       1         X83       monitor_mental_sup4       1         X84       monitor_mental_sup4       1         X85       monitor_mental_sup4       1         X84       monitor_mental_sup4       1         X85       monitor_mental_sup4       1         X85       monitor_mental_sup4	X <sub>76</sub>	Wencourage_mom_AIC, post_info_com_par	1		
ArgsWain_dat_AC, mental_supp1XppWiesh, dat_AC, mental_supp1XppWiesh, dat_Ac, mental_supp1XaiWiesh, dat_Ac, mental_supp1XaiWiesh, dat_Ac, mental_supp1XaiWiesh, dat_Ac, mental_supp1XaiWiesh, dat_Ac, mental_supp1XaiWiesh, dat_Ac, mental_supp1XaiWiesh, dat_Ac, mental_supp1XaiMinotor_acknowl_fat_1Xaimonitor_acknowl_fat_1Xaimonitor_cor_sup_hcp11Xaimonitor_post_info_cor_par_1Xaimonitor_post_info_cor_par_1Xaimonitor_post_info_cor_par_1Xaimonitor_mental_sup_1Xaimonitor_mental_sup_1Xaimonitor_mental_sup_1Xaimonitor_mental_sup_1Xaimonitor_mental_sup_1Xaimonitor_mental_sup_1Xaimonitor_mental_sup_1Xaimonitor_mental_sup_1Xaimonitor_mental_sup_1XaiWide_risk_lowelt, calm_dat_E1XaiWide_risk_lowelt, calm_dat_E1XaiWide_risk_lowelt, calm_dat_E1XaiWide_risk_lowelt, calm_dat_E1XaiWide_risk_lowelt, calm_dat_E1XaiWide_risk_lowelt, calm_dat_E1XaiWide_risk_lowelt, calm_dat_E1XaiWide_risk_lowelt, calm_dat_E1<	X77	Wrefer_mom_ther_AIC, refer_therapist	1		
No.         No.         No.         No.         No.         No.           Xeo         Wencourage_nom_Altr_methal_sup         1         1         1           Xei         monitor_pre_birth_info         1         1         1           Xei         monitor_acknowl_fat;         1         1         1           Xei         monitor_com_sup_hcpi         1         1         1           Xei         monitor_post_info_com_pari         1         1         1           Xei         monitor_post_info_com_pari         1         1         1           Xei         monitor_mental_supi         1	A78 X70	Calm_dad_AIC, mental_sup	1		
Xa1         Wrefer_mom_ther_AC_mental_sup         1           Xa2         Wryse_om_ACC_Wrecom         1           Xa3         monitor_pre_birth_info         1           Xa4         monitor_nec_birth_info         1           Xa5         monitor_acknowl_fatz         1           Xa6         monitor_com_sup_hcp1         1           Xa6         monitor_com_sup_hcp2         1           Xa7         monitor_com_sup_hcp2         1           Xa8         monitor_post_info_com_pars         1           Xa9         monitor_post_info_com_pars         1           Xa9         monitor_post_info_com_pars         1           Xa9         monitor_mental_sup1         1           Xa9         monitor_mental_sup2         1           Xa9         monitor_mental_sup3         1           Xa9         monitor_mental_sup4         1           Xa9         monitor_mental_sup4         1           Xa9         monitor_mental_sup4         1           Xa9         Woirt_dev_dett_c_det_det_det_det_det_det_det_det_det_det	X <sub>80</sub>	teacn_dad_sup_mom_AIC, mental_sup	1		
$\begin{array}{c c c c c c } & \textbf{W}_{type_com_AC_{type_com}} & 1 & \textbf{M} \\ \hline \textbf{X}_{33} & \textbf{monitor_pre_birth_info} & 1 & \textbf{M} \\ \hline \textbf{X}_{43} & \textbf{monitor_pre_birth_info} & 1 & \textbf{M} \\ \hline \textbf{X}_{44} & \textbf{monitor_acknowl_fat_1} & 1 & \textbf{M} \\ \hline \textbf{X}_{56} & \textbf{monitor_acknowl_fat_2} & 1 & \textbf{M} \\ \hline \textbf{X}_{67} & \textbf{monitor_com_sup_hcp_1} & 1 & \textbf{M} \\ \hline \textbf{X}_{67} & \textbf{monitor_post_info_com_par_2} & 1 & \textbf{M} \\ \hline \textbf{X}_{80} & \textbf{monitor_post_info_com_par_2} & 1 & \textbf{M} \\ \hline \textbf{X}_{90} & \textbf{monitor_post_info_com_par_3} & 1 & \textbf{M} \\ \hline \textbf{X}_{90} & \textbf{monitor_mental_sup_1} & 1 & \textbf{M} \\ \hline \textbf{X}_{23} & \textbf{monitor_mental_sup_2} & 1 & \textbf{M} \\ \hline \textbf{X}_{24} & \textbf{monitor_type_com} & 1 & \textbf{M} \\ \hline \textbf{X}_{26} & \textbf{monitor_type_com} & 1 & \textbf{M} \\ \hline \textbf{X}_{26} & \textbf{monitor_type_com} & 1 & \textbf{M} \\ \hline \textbf{X}_{26} & \textbf{monitor_type_com} & 1 & \textbf{M} \\ \hline \textbf{X}_{26} & \textbf{monitor_type_com} & 1 & \textbf{M} \\ \hline \textbf{X}_{26} & \textbf{monitor_type_com} & 1 & \textbf{M} \\ \hline \textbf{X}_{26} & \textbf{monitor_type_com} & 1 & \textbf{M} \\ \hline \textbf{X}_{26} & \textbf{M}_{27} $	×81	Wrefer_mom_ther_AIC, mental_sup	1		
Xas         monitor_pre_birth_info         1           Xas         monitor_acknowl_fat;         1           Xas         monitor_acknowl_fat;         1           Xas         monitor_acknowl_fat;         1           Xas         monitor_acknowl_fat;         1           Xas         monitor_com_sup_hcp:         1           Xas         monitor_com_sup_hcp:         1           Xas         monitor_post_info_com_par;         1           Xas         monitor_post_info_com_par;         1           Xas         monitor_mental_sup;         1      <	X <sub>82</sub>	Wtype_com_AIC, type_com	1		
Asia         monitor_acknowl_fat;         1           Xsb:         monitor_concoul_fat;         1           Xsb:         monitor_com_sup_hcp1         1           Xsb:         monitor_com_sup_hcp2         1           Xsb:         monitor_com_sup_hcp2         1           Xsb:         monitor_post_info_com_par;         1           Xsb:         monitor_mental_sup;         1           Xsb:         Monit_dev_det_t_det_det_sup;         1           Xsb:         Work_det_t_det_t_star_det_f         1           Xsb:         Work_det_t_det_t_star_det_f         1           Xsb:	×83	monitor_pre_birth_info		1	
$\begin{array}{c c c c c c } & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & $	X <sub>84</sub>	monitor_acknowl_fat		1	
Xap       monitor_com_sup_hcp_t       1         Xap       monitor_post_info_com_par_1       1         Xap       monitor_post_info_com_par_2       1         Xap       monitor_post_info_com_par_3       1         Xap       monitor_post_info_com_par_3       1         Xap       monitor_post_info_com_par_3       1         Xap       monitor_mental_sup_1       1         Xap       monitor_mental_sup_3       1         Xap       monitor_mental_sup_3       1         Xap       monitor_mental_sup_3       1         Xap       monitor_mental_sup_3       1         Xap       monitor_mental_sup_4       1         Xap       monitor_mental_sup_4       1         Xap       monitor_mental_sup_4       1         Xap       monitor_mental_sup_4       1         Xap       Worket_det_set       1         Xap       Worket_det_det_det_det_det_det_det_det_det_d	X85 X86	monitor com sup hcp		1	
Xss         monitor_post_info_com_par;         1           Xss         monitor_mental_sup;         1           Xss         Msirt_det_st_test_encourse;         1           Xss         Wsss_det_st_encourse;         1           Xss         Wsss_det_st_encourse;	X87	monitor_com_sup_hcp2		1	
Xigo         monitor_post_info_com_par2         1           Xigo         monitor_post_info_com_par3         1           Xig1         monitor_refer_therapist         1           Xig2         monitor_mental_sup1         1           Xig3         monitor_mental_sup2         1           Xig6         monitor_mental_sup3         1           Xig6         monitor_mental_sup4         1           Xig6         monitor_type_com         1           Xig6         monitor_decc_tit_sup4         1           Xig6         monitor_decc_tit_sup4         1           Xig6         monitor_type_com         1           Xig6         monitor_decc_tit_sup4         1           Xig7         W_wick_cwicc         1         1           Xig8         Con_feedback         1         1           Xig0         Wickright_t_dec_tit_sup4         1         1           Xig1         Widt_risk_teve1_t_encourgemme_t         1         1           Xig2         Wickright_t_dec_uderw_t         1         1           Xig3         Widt_risk_teve1_t_encourgemme_t         1         1           Xig3         Widt_uderw_t_t teent_sup_mom_t         1         1 <td< td=""><td>X<sub>88</sub></td><td>monitor_post_info_com_par1</td><td></td><td>1</td><td></td></td<>	X <sub>88</sub>	monitor_post_info_com_par1		1	
Xao         monitor_post_info_com_pary         1           Xai         monitor_metral_sup1         1           Xay         monitor_mental_sup2         1           Xay         monitor_mental_sup3         1           Xay         monitor_mental_sup4         1           Xay         Monitor_ment_sup4         1           Xa	×89	monitor_post_info_com_par2		1	
Multiple         Implemental         Implemental           Xg2         monitor_mental_sup1         1           Xg3         monitor_mental_sup2         1           Xg4         monitor_mental_sup3         1           Xg5         monitor_mental_sup4         1           Xg6         monitor_mental_sup4         1           Xg6         monitor_mental_sup4         1           Xg6         monitor_mental_sup4         1           Xg7         Ww_Arcw_Hcc         1           Xg8         con-feedback         1           Xj00         Watr.its_level_c, adm_cd_cl_ <l< td="">         1           Xj01         Watr.its_level_c, adm_cd_cl_<l< td="">         1           Xj02         Wurger_its_its_evel_c, adm_cd_merw_E         1           Xj03         Watr.its_level_c, adm_cd_merw_E         1           Xj03         Watr.its_its_evel_c adm_cd_merw_E         1           Xj03         Watr.its_its_mback_dd_sug_mom_E         1           Xj04         Watr.its_mback_dd_sug_mom_E         1           Xj05         Wurge_monit_E, trape_ddm_that         1           Xj05         Wurge_monit_erm_E that indet         1           Xj05         Wurge_monit_erm_E that         1</l<></l<>	X <sub>90</sub>	monitor_post_info_com_par3		1	
Monitor_mental_supp         1           Xas         monitor_mental_supp         1           Xas         monitor_mental_supp         1           Xas         monitor_mental_supp         1           Xas         monitor_type_com         1           Xas         con_feedback         1           Xas         con_feedback         1           Xas         vw_sis_is_ec, is_ec, is_	X91 X92	monitor mental sup		1	
Xps         monitor_mental_sup3         1           Xps         monitor_mental_sup4         1           Xps         monitor_type_com         1           Xps         Ww_ALCW_HCP         1           Xps         Con_feedback         1           Xi0         Wate_risk_evet_fenourgeg_mon_E         1	X <sub>93</sub>	monitor_mental_sup <sub>2</sub>		1	
Xas         monitor_mental_supa         1           Sas         monitor_type_com         1           Xas         monitor_type_com         1           Xas         Con_feedback         1         1           Xas         Mu_ALS.W.HCP         1         1           Xas         Con_feedback         1         1           Xas         Work_dwt_dwt_dwt_dwt_dwt_dwt_dwt_dwt_dwt_dwt	X <sub>94</sub>	monitor_mental_sup <sub>3</sub>		1	
Xap:         monitor_type_com         1         I           Xay:         Ww.Aicw.HCP         1         1           Xap:         Con_feedback         1         1           Xap:         Woirt_init_event         1         1         1           Xap:         Woirt_init_event         1         1         1         1           Xap:         Woirt_init_event         1 <td>X<sub>95</sub></td> <td>monitor_mental_sup<sub>4</sub></td> <td></td> <td>1</td> <td></td>	X <sub>95</sub>	monitor_mental_sup <sub>4</sub>		1	
App         WW_MACW_HCP         I           Sage         Con_[eedback         1           Xage         Winth, dev_det_, dist, well.         1           Xage         Winth, dev_det_, resurvageme_E         1           Xio0         Wate, risk_level_E, colm_dad_E         1           Xio1         Wate, risk_level_E, colm_dad_E         1           Xio2         Ware_lifek_e, dist_wade_E         1           Xio3         Wate_underw_E, reservageme_E         1           Xio4         Con	X <sub>96</sub>	monitor_type_com	1	1	
App         District decoded.         L           Xpp         Mostrict_dec_dect_dest_risk_level_E         1           X100         Wate_risk_level_E, and_rade.         1           X101         Wate_risk_level_E, and_rade.         1           X102         Ware_risk_level_E, and_rade.         1           X103         Wate_risk_level_E, and_rade.         1           X104         Wate_risk_level_E, and_rade.         1           X105         Wate_risk_revel_E, and_rade.         1           X104         Wate_risk_revel_E, and_rade.         1           X105         Wate_risk_revel_E, and_rade.         1           X105         Wate_risk_revel_E, and_rade.         1           X105         Wate_risk_revel_E, and_rade.         1           X105         Wate_risk_revel_E, and_rade.         1           X106         Wate_risk_revel_E, and_rade.         1           X105         Wate_risk_revel_E, and_rade.         1           X106         Wate_risk_revel_E, and_rade.         1           X107         Wate_risk_revel_E, and_rade.         1           X108         Con_feedforward         1	A97 Xoz	con feedback	-		1
X100         W det_risk_level_E, encourage_mom_E         1           X101         W det_risk_level_E, ancourage_mom_E         1           X102         W rr, birth, weights L, det_underw_E         1           X103         W det_underw_E, refer_mom_ther_E         1           X104         W det_underw_E, refer_mom_ther_E         1           X105         W det_underw_E, refer_mom_ther_E         1           X106         W getw_underw_E, test-ided_usu_mom_E         1           X107         W upbw_ubm_E, type_dom_E         1           X107         W up_Lw_ARC         1           X108         con_feedforward         1	X <sub>99</sub>	Wbirth_dev_det_E, det risk level F	1		
Xi01         Wdet_risk_level_E.calm_dad_E         1           Xi02         Wirr_pirk_dwight_E.det_underw_E         1           Xi03         Wdet_underw_E.teet_nom.ther_E         1           Xi04         Wdet_underw_E.teet_nom.ther_E         1           Xi05         Wdet_underw_E.teet_nom.ther_E         1           Xi06         Wyasymont_E.teet_nom.ther_E         1           Xi06         Wyasymont_E.teet_nom.ther_E         1           Xi07         Wus_kw_ARC         1           Xi08         con_feedforward         1	×100	Wdet_risk_level_E, encourage_mom_E	1		
Xi02         Wurr Joinh, weight, E, det "underw. E         1           Xi03         Wade, underw. E, refer, mon, Iher, E         1           Xi04         Wade, underw. E, refer, mon, Iher, E         1           Xi05         Wade, underw. E, refer, mon, Iher, E         1           Xi05         Wabe, underw. E, refer, mon, Iher, E         1           Xi05         Wurpe, none, E, rep, birth, foot.         1           Xi06         Wurpe, mon, E, mo, birth, foot.         1           Xi07         Wurpe, wang, Con, E for efforward.         1	X <sub>101</sub>	Wdet_risk_level_E, calm_dad_E	1		
X103         W det_underw_E, refer_mom_ther_E         1           X104         W det_underw_E, resch_dtal_sup_mom_E         1           X105         W baby_born_E, type_com_E         1           X106         W (spam_mom_E, pre_binh_infog E         1           X107         W w_E, w_A, or         1           X108         con_feedforward         1	X <sub>102</sub>	Wirr_birth_weight_E, det_underw_E	1		
Yung         Weight underwich teter inder ubig mean _E         X           Xion         Wipsey mean _E pre_ birth _info _E         1           Xion         Wipsey mean _E pre_ birth _info _E         1           Xion         Con_feedforward         1	×103	W det_underw_E, refer_mom_ther_E	1		
X006         Wype_mom_E_pre_birth_info_t         1           X107         Ww_E.w.atc         1           X108         con_feedforward         1	X104 X105	What where E type com 5	1		
X107         Ww_Ew_Aic         1           X108         con_feedforward         1	×105	Wtype_mom_E, pre_birth_info_E	1		
X <sub>108</sub> con_feedforward 1	X <sub>107</sub>	W <sub>W_E,W_AIC</sub>	1		
	X <sub>108</sub>	con_feedforward	1		

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# Table 33

Role Matrix for Case (d) for **mcfp** – Combination Function Parameters.

mcfp -	combination function parameters	1 Alogistic	2 Monitor	3 Steponce
×.	type mom	Steepness Threshold	Threshold	Start Time End Time
X2	artificiality_birth	50 0.	5	
×3	epidural_used	50 0.	5	
X <sub>4</sub>	deliv_baby	5 0.	5	
x <sub>6</sub>	MPPD	5 0.	ŝ	
X7	PPPD	5 0.	5	
X <sub>8</sub> X.	kid_devel	5 0.	5	
×9 ×10	com_sup_hcp	0.5	3	
×11	fat_ask_sup_com	5	L	
X <sub>12</sub>	fat_rec_sup_com	5 0.	5	
A13 X14	refer_therapist	5	i l	
X15	mental_sup	0.5	5	
X16	acknowl_fat	5 0.	3	
X <sub>17</sub> X <sub>18</sub>	age riskiness	5 0.	5	
X19	dilation_mom	2.8	D .	
X <sub>20</sub>	premature_birth	5 0.	5	
×21 X22	type_com retention	5 0.	3	
X23	engaged	5 0.	5	
X <sub>24</sub>	stress	5 0.	5	
X <sub>25</sub> X <sub>16</sub>	fear level	50		
X27	desire_sup	5 0.	3	
X28	ask_sup	5 0.	2	
X <sub>29</sub> X <sub>20</sub>	det risk leveluse	5 0		
X31	encourage_mom <sub>HCP</sub>	5 0.	5	
X32	calm_dad <sub>HCP</sub>	50 0.	7	
X33 V	irr_birth_weight <sub>HCP</sub>	5		
X34 X35	refer_mom_theree	50 0.	5	
X36	teach_dad_sup_mom <sub>HCP</sub>	50 0.	7	
X37	baby_born <sub>HCP</sub>	5 0.	5	
×38 ×30	type_com <sub>HCP</sub>	5 0.	5	
X40	pre_birth_info <sub>HCP</sub>	50 0.	5	
X41	birth_dev_det <sub>Aic</sub>	5	L	
X <sub>42</sub>	det_risk_levelac	5 0.		
X44	calm_dad <sub>aic</sub>	50 0.	7	
X45	irr_birth_weight <sub>AIC</sub>	5	L	
X46	det_underwaic	5 0.	5	
A47 X49	teach dad sup momain	50 0.		
X49	baby_born <sub>AIC</sub>	5 0.	5	
X <sub>50</sub>	type_com <sub>AIC</sub>	50 0.	5	
X <sub>51</sub> X <sub>52</sub>	type_mom <sub>AIC</sub>	5 0.		
X <sub>53</sub>	Wbirth_dev_det_HCP, det_risk_level_HCP	5 0.	5	
X54	W_det_risk_level_HCP, encourage_mom_HCP	5 0.	5	
X <sub>55</sub> X <sub>10</sub>	Wdet_risk_level_HCP, calm_dad_HCP	5 0.		
X <sub>57</sub>	Wdet_underw_HCP, refer_mom_ther_HCP	5 0.	5	
x <sub>sa</sub>	W_det_underw_HCP, teach_dad_aup_mom_HCP	5 0.	5	
×59	Wbaby_born_HCP, type_com_HCP	5 0.	5	
X <sub>61</sub>	Wbirth day det AIC det risk level AIC	5 0.	5	
X <sub>62</sub>	Wdet_risk_level_AIC, encourage_mom_AIC	5 0.	5	
X63	Wdet_risk_level_AIC, calm_dad_AIC	5 0.		
A64 X65	Wer_birth_weight_AIC, det_underw_AIC	5 0.	5	
×cc	W_det_underw_AIC, teach_dad_sup_mom_AIC	5 0.	5	
X <sub>67</sub>	Wbaby_born_AIC, type_com_AIC	5 0.	5	
X <sub>60</sub> X <sub>en</sub>	Wype_mom_AIC, pre_birth_info_AIC	5 0.		
X70	Wcaim_dad_AIC, acknowl_fat	5 0.	5	
×71	Wteach_dad_sup_mom_AIC, acknowl_fat	5 0.	5	
X <sub>72</sub> X	Wcalm_dad_AIC, com_sup_hcp	5 0. 5 0		
X74	Wcalm_dad_AIC, post_info_com_par	5 0.	5	
×75	Wteach_dad_sup_mom_AIC, post_info_com_par	5 0.	5	
X76	Wencourage_mom_AIC, post_info_com_par	5 0.	5	
X <sub>78</sub>	reter_mom_ther_AIC, reter_therapist     Wcalm_dad_AIC, mental_sup	5 0.	5	
X79	Wteach_dad_sup_mom_AIC, mental_sup	5 0.	5	
X80	Wencourage_mom_AIC, mental_sup	5 0.	5	
×a1 Xa1	Wrefer_mom_ther_AIC, mental_sup	5 U. 5 O.		
X <sub>83</sub>	monitor_pre_birth_info		0.6	
×a4	monitor_acknowl_fat1		0.6	
X <sub>85</sub> X <sub>1</sub>	monitor_acknowl_tat2 monitor_com_sup_bcp.		0.6	
X87	monitor_com_sup_hcp2		0.6	
×88	monitor_post_info_com_par <sub>1</sub>		0.6	
X <sub>ao</sub>	monitor_post_info_com_par2		0.6	
X91	monitor_refer_therapist		0.6	
X <sub>92</sub>	monitor_mental_sup1		0.6	
X <sub>93</sub>	monitor_mental_sup2		0.6	
A94 X95	monitor_mental_supa		0.6	
X96	monitor_type_com		0.6	
X <sub>97</sub>	Ww_AIC,W_HCP	30 0.5		
X <sub>98</sub> X <sub>99</sub>	con_reedback	50 0.5		40 80
×100	Wdet_risk_level_E, encourage_mom_E	50 0.5		
X <sub>101</sub>	Wdet_risk_level_E, calm_dad_E	50 0.5		
X102	Wirr_birth_weight_E, det_underw_E	50 0.5		
X <sub>104</sub>	out_underw_E, refer_mom_ther_E     Wdet_underw_E, teach_dad_sup_mom_E	50 0.5		
X <sub>105</sub>	Whaby_born_E, type_com_E	50 0.5		
X106	Wtype_mom_E, pre_birth_info_E	50 0.5		
X107	con_feedforward	5 0.5		

has a lasting effect on the overall learning. This stems from the fact, that repeated and increasing exposure to the stimulus of the HCP being asked for support communication accelerates adaptation and can lead to longterm learning (Robinson et al., 2016). Similar to the safety culture, organizational learning allows for an ever-evolving growth of knowledge and creates stronger foundations for new and current HCPs in the medical field. This was reflected by using the notion of feedforward and feedback in the study. Applying the Virtual Safety Coach into the field and treating it as an individual reaps the benefits of using it to create a shared mental model based on the mental models existing within experts and, through this further education and improvement in medical practices. The combination of various mental models to create a shared

Role Matrix for Case (d) for **iv** – Initial Values.

×1 ×		
$\sim$	type_mom	1
<b>^</b> 2	artificiality_birth	1
X <sub>3</sub>	epidural_used	1
X4	deliv_baby	0.2
Xs	baby_born	0.1
×6	MPPD	0.2
X7	PPPD	1
×8	kid_devel	1
X9 V	pre_birth_into	0.1
×10	com_sup_ncp	0.1
×11 ×	fat_ask_sup_com	0.3
A12 X	nost info com par	0.1
X13 X	refer therapist	0.3
XII	mental sup	0.1
Xis	acknowl fat	0.1
X17	age	0
X18	riskiness	0.5
X19	dilation_mom	1
X20	premature_birth	0
X <sub>21</sub>	type_com	1
X <sub>22</sub>	retention	1
X <sub>23</sub>	engaged	1
X24	stress	0.4
X <sub>25</sub>	birth_dev	1
X <sub>26</sub>	fear_level	1
X <sub>27</sub>	desire_sup	1
X <sub>28</sub>	ask_sup	0.2
X <sub>29</sub>	birth_dev_det <sub>HCP</sub>	1
X <sub>30</sub>	det_risk_level <sub>HCP</sub>	1
X <sub>31</sub>	encourage_mom <sub>HCP</sub>	0.1
X <sub>32</sub>	calm_dad <sub>HCP</sub>	0.1
X <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	1
X34	det_underw <sub>HCP</sub>	1
X35	refer_mom_ther <sub>HCP</sub>	0.3
X <sub>36</sub>	teach_dad_sup_mom <sub>HCP</sub>	0.1
X <sub>37</sub>	baby_born <sub>HCP</sub>	1
X <sub>38</sub>	type_com <sub>HCP</sub>	1
X <sub>39</sub>	type_mom <sub>HCP</sub>	1
X40	pre_birth_info <sub>HCP</sub>	1
X41	birth_dev_det <sub>AIC</sub>	0.33
X <sub>42</sub>	det_risk_level <sub>AIC</sub>	0.33
X <sub>43</sub>	encourage_mom <sub>AIC</sub>	0.033
X44	calm_dad <sub>AIC</sub>	0.033
X <sub>45</sub>	irr_birth_weight <sub>AIC</sub>	0.33
×46	det_underwaic	0.33
×47	tooch dod cup mom	0.1
A48	teach_dad_sup_mom <sub>AIC</sub>	0.035
A49	baby_born <sub>AIC</sub>	0.55
^50 V	type_com <sub>Aic</sub>	0.33
×51 X-1	pre birth info	0.33
X52	W	1
X53	Wdet sick level MCP ansaurage mam MCP	1
Xcc	Wdat rick level HCP calm dad HCP	1
Xse	Wire birth weight HCP det underer HCP	1
X57	Wdat undarw MCP refer mom than MCP	1
X58	Wdat undarge HCP, teach dad sup mom HCP	1
X59	Whatev born HCR type com HCR	1
X <sub>60</sub>	Wryne mom HCP are birth info HCP	1
X <sub>61</sub>	Whith day det AIC det risk level AIC	0.5
X <sub>62</sub>	Wdet risk level AIC encourage mom AIC	0.5
	Wdet_risk_level_AIC, calm_dad_AIC	
A63		0.5
×63 ×64	Wirr_birth_weight_AIC, det_underw_AIC	0.5 0.5
X <sub>63</sub> X <sub>64</sub> X <sub>65</sub>	Wirr_birth_weight_AIC, det_underw_AIC Wdet_underw_AIC, refer_mom_ther_AIC	0.5 0.5 0.5
X <sub>63</sub> X <sub>64</sub> X <sub>65</sub> X <sub>66</sub>	Wirr_birth_weight_AIC, det_underw_AIC Wdet_underw_AIC, refer_mom_ther_AIC Wdet_underw_AIC, teach_dad_sup_mom_AIC	0.5 0.5 0.5 0.5
× <sub>63</sub> × <sub>64</sub> × <sub>65</sub> × <sub>66</sub> × <sub>67</sub>	Wirr_birth_weight_AIC, det_underw_AIC           Wdet_underw_AIC, refer_mom_ther_AIC           Wdet_underw_AIC, teach_dad_sup_mom_AIC           Wbaby_born_AIC, type_com_AIC	0.5 0.5 0.5 0.5 0.5
X <sub>63</sub> X <sub>64</sub> X <sub>65</sub> X <sub>66</sub> X <sub>67</sub> X <sub>68</sub>	Wirr_birth_weight_AIC, det_underw_AIC Wdet_underw_AIC, röfer_mom_ther_AIC Wdet_underw_AIC, reach_dad_sup_mom_AIC Wbaby_born_AIC, type_com_AIC Wtype_mom_AIC, pre_birth_Info_AIC	0.5 0.5 0.5 0.5 0.5 0.5
X <sub>63</sub> X <sub>64</sub> X <sub>65</sub> X <sub>66</sub> X <sub>67</sub> X <sub>68</sub> X <sub>59</sub>	Wirr_birth_weight_ALC, det_underw_ALC Wdet_underw_ALC, refer_mom_ther_ALC Wdet_underw_ALC, tead-ada_up_mom_ALC Wbaby_born_ALC, tead-ada_up_mom_ALC Wbaby_born_ALC, type_com_ALC Wtype_mom_ALC, pre_birth_info_ALC Wpre_birth_info_ALC, pre_birth_info	0.5 0.5 0.5 0.5 0.5 0.5 0.5
X <sub>63</sub> X <sub>64</sub> X <sub>65</sub> X <sub>66</sub> X <sub>67</sub> X <sub>68</sub> X <sub>69</sub> X <sub>70</sub>	Wirz_birt_weight_ARG det_underw_ARC Weist_underw ARC teal, dat_stop_mom_ARC Weist_underw ARC teal, dat_stop_mom_ARC Wishey_born_ARC type_com_ARC Wishey_born_ARC pre_birth_Inde_ARC Wirze_mom_ARC, pre_birth_Inde	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X <sub>63</sub> X <sub>64</sub> X <sub>65</sub> X <sub>66</sub> X <sub>67</sub> X <sub>68</sub> X <sub>69</sub> X <sub>70</sub> X <sub>71</sub>	Wire_birth_weight_A.C.G. det_underw_A.C.C     Wate_underw_A.C.C     Wate_underw_A.C.G. enter_mom_hite_A.C.C     Wate_underw_A.C.G. exach_dad_sup_mom_A.C.C     Wusey_born_A.C.G. expe_com_A.C     Wyrey_mom_A.C.G. pre_birth_infe_A.C.C     Wyrey_birth_infe_A.C.G. pre_birth_infe_A.C     Wyrey_birth_infe_A.C.G.C.C.C.C.C.C.C.C     Wired_dad_A.G.G.C.C.C.C.C.C.C.C.C     Wired_dad_sup_mom_A.C.C.Acknowl_fat	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X65 X65 X67 X67 X68 X69 X70 X70 X71 X72		0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X65 X65 X66 X67 X68 X69 X70 X70 X71 X72 X73		0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X65 X66 X67 X68 X69 X69 X70 X71 X72 X72 X72 X73 X74	Wire_birt_Act(det_onterw_Att           Wire_birt_Act(det_onterw_Att           Wate_underw_Att           Wate_underw_Att </td <td>0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5</td>	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X67 X68 X69 X70 X71 X72 X73 X73 X73 X73 X73 X74 X75 X74		0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X65 X67 X67 X67 X70 X71 X71 X72 X73 X73 X74 X75 X76 X75 X76 X75		0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X67 X68 X69 X70 X71 X72 X73 X74 X73 X74 X75 X76 X77 X77 X76 X77	Wire_birt_weight_ACL det_underw_ACL Wates_underw_ACL det_underw_ACL Wates_underw_ACL refer_nom_hire_ACL Wates_underw_ACL refer_nom_hire_ACL Wates_underw_ACL refer_tom_hire_ACL Wates_underw_ACL gre_birth_Info_ACL Wyre_on_add_ACL gre_birth_Info_ACL Wyreat_unded_ACL gre_birth_Info Watest_unded_ACL gre_birth_Info Watest_under_ACL gre_birth_Info_com_par Watest_under_ACL gre_birth_Info_com_par	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X65 X67 X67 X67 X70 X71 X72 X73 X73 X73 X74 X75 X76 X77 X78 X75 X77 X78 X75	Wirr_pirth_weight_ACL det_underw_ALC Wiat_underw ALC teat_mat_Mat_ALC Wiat_underw ALC teat_dat_spp_mom_ALC Wisbay_born_ALC type_com_ALC Wisbay_born_ALC type_com_ALC Wyre_mom_ALC pre_birth_info.ALC Wyre_birth_info.ALC pre_birth_info Worlind_idd_ALC com_Sup_hop Wicash_dat_sup_mom_ALC acknowl_fat Wicash_idd_sup_mom_ALC com_Sup_hop Wicash_idd_sup_mom_ALC com_sup_hop Wicash_idd_sup_mom_ALC com_sup_hop Wicash_idd_sup_mom_ALC com_par Wicash_idd_sup_mom_ALC com_par Wicash_idd_sup_mom_ALC post_info_com_par Wicash_idd_sup_mom_ALC post_info_com_par Wicash_idd_sup_mom_ALC post_info_com_par Wicash_idd_sup_mom_ALC post_info_com_par Wicash_idd_sup_mom_ALC post_info_com_par Wicash_idd_sup_mom_ALC post_info_com_par	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X67 X68 X70 X71 X72 X72 X73 X74 X73 X74 X75 X75 X75 X75 X75 X75 X75 X75 X75 X75	Wirz-pirt-weight_ACL de_underw_ALC Wide_underw_ALC, det_underw_ALC Wide_underw_ALC, treez-nom_bite_ALC Wide_underw_ALC, treez-nom_bite_ALC Wirze_mon_ALC, pre_birth_Infe.ALC Wirze_mon_ALC, derkowl_fat Wirzent_dat_ALC, com_sup_hep Wirzent_dat_ALC, com_sup_hep Wirzent_dat_Sup_mom_ALC, com_sup_hep Wirzent_dat_Sup_mom_ALC, com_sup_hep Wirzent_dat_Sup_mom_ALC, com_sup_hep Wirzent_dat_Sup_mom_ALC, com_sup_hep Wirzent_dat_Sup_mom_ALC, com_sup_hep Wirzent_dat_Sup_mom_ALC, com_sup_hep Wirzent_dat_Sup_mom_ALC, com_sup_hep Wirzent_dat_Sup_mom_ALC, com_sup_hep Wirzent_dat_Sup_mom_ALC, post_Infe_com_par Wirzent_dat_Sup_mom_ALC, post_Infe_com_par Wirzent_dat_Sup_mom_ALC, post_Infe_com_par Wirzent_dat_Sup_mom_ALC, post_Infe_com_par Wirzent_dat_Sup_mom_ALC, post_Infe_com_par Wirzent_dat_Sup_mom_ALC, post_Infe_com_par	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X66 X60 X70 X71 X71 X72 X73 X74 X75 X74 X75 X76 X77 X78 X75 X75 X79 X79 X80 X81	Wirr_pinth_weight_ACL det_underw_ALC Wist_underw ALC teach_dat_sup_mom_ALC Wist_underw ALC teach_dat_sup_mom_ALC Wistpy_mom_ALC type_com_ALC Wistpy_mom_ALC type_com_ALC Wirre_mom_ALC pre_birth_Info Wirred_tad_tad_sup_mom_ALC acknow_fait Wirred_tad_tad_sup_mom_ALC acknow_fait Wirred_tad_tad_sup_mom_ALC acknow_fait Wirred_tad_tad_sup_mom_ALC com_sup_hap Wirred_tad_tad_sup_mom_ALC com_sup_hap Wirred_tad_tad_sup_mom_ALC com_sup_hap Wirred_tad_tad_sup_mom_ALC com_sup_hap Wirred_tad_sup_mom_ALC com_sup_hap Wirred_tad_sup_hap_hap_hap_hap_hap_hap_hap_hap_hap_ha	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X67 X68 X70 X71 X72 X72 X73 X74 X75 X76 X77 X78 X77 X78 X79 X79 X79 X79 X79 X79 X79 X80 X81 X82	Wirz_birt_weight_ACL det_underw_ALC Wiat_underw ALC teat_inter_ALC Wiat_underw ALC teat_and_sup_mom_ALC Wisby_bort_ALC type_com_ALC Wisby_bort_ALC type_com_ALC Wyre_mom_ALC pre_birth_Info Worlm_dad_ALC, adnowl_fat Wisand_dad_ALC, adnowl_fat Wisand_dad_ALC, com_sup_hap Wisand_dad_ALC, post_Info_com_par Wisand_dad_Sup_mom_ALC com_Sup_hap Wisand_dad_ALC, post_Info_com_par Wisand_dad_ALC, post_Info_com_par Wisand_dad_ALC, post_Info_com_par Wisand_dad_ALC, post_Info_com_par Wisand_dad_ALC, post_Info_com_par Wisand_dad_ALC, post_Info_com_par Wisand_dad_ALC, post_Info_com_par Wisand_dad_ALC, post_Info_com_par Wisand_dad_ALC, mental_sup Wisand_dad_ALC, mental_sup Wisand_dad_ALC, mental_sup Wisand_dad_ALC, mental_sup Wisand_dad_ALC, mental_sup	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X67 X69 X70 X71 X72 X73 X73 X73 X73 X73 X73 X75 X75 X75 X75 X75 X75 X76 X77 X78 X78 X78 X78 X78 X81 X81 X82 X81 X83	Wirz_birt_weight_ACL det_underw_ALC Widet_underw_ALC det_underw_ALC Widet_underw_ALC, teach_dad_sup_mom_ALC Widet_underw_ALC, teach_dad_sup_mom_ALC Wirze_mom_ALC, pre_birth_Infe.ALC Wirze_mom_ALC, detcowl_fat Wraind_add_ALC, com_sup_hep Wirzed_uds_up_mom_ALC, andshowl_fat Wirzed_uds_up_mom_ALC, com_sup_hep Wirzed_uds_up_mom_ALC, mental_sup Wirzed_uds_up_mom_ALC, mental_sup Wirzed_uds_up_mom_ALC, mental_sup Wirzed_uds_up_mom_ALC, mental_sup Wirzed_uds_up_mom_ALC, mental_sup	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X66 X67 X70 X72 X72 X72 X74 X74 X74 X75 X76 X77 X78 X75 X77 X78 X75 X79 X76 X77 X78 X74 X74 X74 X74 X74 X74 X74 X74 X74 X74	Wirz_birt_weight_ACL (d=_underw_ALC           Wirz_birt_weight_ACL (d=_underw_ALC           Widz_underw ALC (seaf, dat_up_mom_ALC           Wisby_bort_ALC (type_com_ALC           Wisby_bort_ALC (type_com_ALC           Wysb_underw ALC (seaf, dat_up_mom_ALC           Wysb_underw ALC (seaf, dat_up_mom_ALC           Wysb_underw ALC (seaf, dat_up_mom_ALC           Wysb_underw ALC (seaf, dat_up_mom_ALC, seaf, dat_up_mom_ALC, seaf, dat_up_mom_ALC, com_sup_htp           Wissd_udat_up_mom_ALC, com_up_htp           Wissd_udat_up_mom_ALC, com_up_htp           Wissd_udat_up_mom_ALC, com_up_htp           Wissd_udat_up_mom_ALC, com_up_htp           Wissd_udat_Up_mom_ALC, com_up_htp           Wissd_udat_Up_mom_ALC, com_up_mer           Wissd_udat_Up_mom_ALC, com_up_mer           Wissd_udat_Up_mom_ALC, mental_sup           Wissd_udat_Up_mom_ALC, mental_sup           Wissd_udat_Up_mom_ALC, mental_sup           Wissd_udat_Us_up_mom_ALC, mental_sup           Wissd_udat_Us_up_mom_ALC, mental_sup           Wissd_udat_Us_up_mom_ALC, mental_sup           Wissd_udat_Us_Up_mom_ALC           Wissd_udat_Us_Up_mom_ALC           Wissd_udat_Us_Up_mom_ALC           Wissd_udat_Us_Up_mom_ALC           Wissd_udat_Us_Up_mom_ALC           Wissd_udat_Us_Up_mom_ALC           Wissd_udat_Us_Up_mom_ALC     <	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X67 X60 X70 X71 X72 X73 X73 X73 X73 X73 X75 X75 X75 X75 X75 X75 X75 X75 X75 X75	Wire_pirtweightACL_6 =mderwALC     Wateunderw_ALC, 6 =mmatALC     Wateunderw_ALC, 1 = eachdadsupmomALC     Wateunderw_ALC, 1 = eachdadsupmomALC     WatemathdadsupmomALC, eachdadsupmomALC     WreemmatALC, escbirthInfo     WreemathdadALC, eachdadsupmomALC, eachnowl_fat     WiseaddadsupmomALC, eachdadsupmomALC, eachnowl_fat     WiseaddadsupmomALC, eachdadsupmomALC, eachnowl_fat     WiseaddadsupmomALC, eachdadsupmomALC, eachnowl_fat     WiseaddadsupmomALC, eachdadsupmomALC, eachdadsupmomALC, eachdadsupmomALC, eachdadsupmomALC, eachdadsupmomALC, eachdadsupmomALC, eachsupsupsupsupsupsupsupsu	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X66 X69 X70 X71 X72 X74 X74 X75 X74 X75 X76 X77 X76 X77 X78 X76 X77 X78 X78 X81 X81 X81 X83 X83 X83 X83 X83 X85 X85 X85 X85 X85 X85 X85 X77 X77 X77 X77 X77 X77 X77 X77 X77 X7	Wirz_birt_weight_ACG (d=_underw_ACC           Wirz_birt_weight_ACG (d=_underw_ACC           Wide_underw ACF (refer_mom_hirt_ACC           Wisby_bort_ACG (refer_mom_hirt_hat_ACC           Wisby_bort_ACG (refer_mom_hirt_hat_ACC           Wisby_bort_ACG (refer_mom_hirt_hat_ACC           Wird_underw_ACG, each add_sup_mom_ACC           Wird_underw_ACG, refer_mom_hirt_hat_ACC           Wird_underw_ACG, cons.tup_hat           Wird_underw_ACG, cons.tup_hat           Wird_underw_ACG, cons.tup_hat           Wird_underw_ACG, cons.tup_hat           Wird_underw_ACG, cons.tup_hat           Wirderd_underw_ACG, cons.tup_hat           Wirderd_underw_ACG, cons.tup_hat           Wirderd_underw_ACG, cons.tup_hat           Wirderd_underw_ACG, cons.tup_hat           Wirder_underw_ACG, cons.tup_hat           Wirder_underw_ACG, cons.tup_hat           Wirderw_ACG, conseredw_Lats           Wire	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X69 X71 X72 X73 X74 X73 X73 X74 X75 X75 X75 X75 X75 X75 X75 X75 X75 X75	Wire_init_weight_ACG det_underw_ACC Wiat_underw ALC feet_nom_init_ACC Wiat_underw ALC feet_nom_init_ACC Wisely_born_ACC type_com_ACC Wisely_born_ACC type_com_ACC Wyre_mom_ACG pre_birth_Info Worlin_did_ACC com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Wisely_did_Com_stup_hon Mirpe_com_ACC, type_com Mirpe_com_ACC, type_com Mirpe_com	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X70 X70 X71 X72 X73 X74 X73 X74 X75 X76 X77 X76 X77 X78 X77 X78 X78 X78 X78 X78 X78 X81 X82 X83 X84 X84 X85 X86 X86 X86 X86 X66 X70 X70 X70 X70 X70 X70 X70 X70 X70 X70	Wire_juitweight_ACL detunderw_ALC Wiatunderw_ALC, detunderw_ALC Wiatunderw_ALC, teach_dad_sup_mom_ALC Wiseunderw_ALC, teach_dad_sup_mom_ALC Wiseunderw_ALC, pre_linth_Infe_ALC Wireond_ALC, pre_linth_Infe_ALC Wiread_underw_ALC, acknowl_fat Wiread_underw_ALC, acknowl_fat Wiread_underw_ALC, acknowl_fat Wiread_underw_ALC, acknowl_fat Wiread_underw_ALC, acknowl_fat Wiread_underw_ALC, acknowl_fat Wiread_underw_ALC, post_Info_com_par Wiread_underw_ALC, post_Info_com_par Wiread_underw_ALC, pest_Info_com_par Wiread_underw_ALC, pest_Info_com_par Wiread_underw_ALC, mental_sup Wiread_underw_ALC, mental_sup Wiread_underw_ALC, mental_sup Wiread_underw_ALC, mental_sup Wiread_underw_ALC, mental_sup Wiread_underw_ALC, mental_sup Wiread_underw_ALC, mental_sup Wiread_underw_ALC, mental_sup Wiread_underw_ALC, mental_sup Miread_underw_ALC, mental_sup Miread_underw_AL	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X67 X68 X70 X70 X71 X72 X74 X74 X75 X74 X75 X76 X77 X76 X77 X76 X77 X78 X81 X81 X81 X82 X83 X83 X83 X85 X85 X85 X85 X85 X85 X85 X85 X85 X85	Wire_juntweight_ACL (d=_underw_ALC           Wire_junt_weight_ACL (d=_underw_ALC           Wide_underw ALC (refer_mom_hire_ALC           Wisby_jorn_ALC (ypc_om_ALC           Wisby_jorn_ALC (ypc_om_ALC           Wisby_jorn_ALC (ypc_om_ALC           Wyre_mom_ALC, pre_birth_Info           World_idad.(C, cons.ypc_hire)           Wisby_jorn_ALC (refer_mom_Step_field           Wisby_dorm_ALC (cons.ypc_hire)           Wisby_dorm_ALC (cons.ypc_hire)           Wisby_dorm_ALC (cons_ypc_hire)           Wisby_dorm_ALC (cons_ypc_hire)           Wisby_dorm_ALC (cons_ypc_hire)           Wisbed_dol_Sup_mom_ALC (cons_ypc_hire)           Wisbed_dol_Sup_mom_ALC (cons_ypc_hire)           Wisbed_dol_Sup_mom_ALC (cons_ypc_hire)           Wisbed_dol_Sup_mom_ALC (cons_ypc_hire)           Wisbed_dol_Sup_mom_ALC (mental_sup           Wireder_mom_ther_ALC (mental_sup           Wireder_mom_ther_Ther_MON (mental_sup           Wireder_mo	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X69 X70 X71 X72 X73 X73 X73 X73 X73 X73 X75 X75 X75 X75 X75 X75 X75 X75 X75 X75	Wire_init_weight_ACL det_inderw_ALC Wiat_underw_ALC teat_inderw_ALC Wiat_underw_ALC teat_inde_inde_inderw_ALC Wisely_borr_ALC type_com_ALC Wire_mom_ALC pre_birth_Inde_ALC Wire_tow_ALC teath_Inde_ALC Wire_tow_ALC teath_Inde Wired_inde_inde_inderwide Wired_inde_inde_inderwide Wired_inde_inde_inderwide Wired_inde_inde_inderwide Wired_inde_inde_inderwide Wired_inde_inde_inderwide Wired_inde_inde_inderwide Wired_inde_inde_inderwide Wired_inde_inde_inderwide Wired_inde_inde_inderwide Wired_inderwide Wired_inde_inde_inderwide Wired_	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X70 X70 X71 X72 X71 X72 X74 X73 X74 X75 X77 X79 X76 X77 X79 X80 X81 X81 X82 X81 X82 X81 X82 X83 X86 X87 X81 X86 X87 X81 X82 X81 X86 X81 X81 X81 X81 X81 X81 X81 X81 X81 X81	Wire_juirt_weight_ACG det_underw_ACC Wist_underw ACF refer_mom_het_ACC Wist_underw ACF refer_mom_het_ACC Wisty_pom_ACR (refer_mom_het_ACC Wisty_pom_ACC pre_juirt_inde_ACC Wire_mid_ad_ACF cent_unde_het_ACC Wire_dist_dist_set_pom_ACF, acknowl_dist Wiredit_dist_com_sup_het Wiredit_dist_pom_ACF, pom_info_com_par Wiredit_dist_pom_ACF, com_uper Wiredit_dist_pom_ACF, com_inp. Wiredit_dist_pom_ACF, com_inp. Wiredit_dist_pom_ACF, com_inp. Wiredit_dist_pom_ACF, com_inp. Wiredit_dist_pom_ACF, com_inp. Wiredit_dist_pom_ACF, com_inp. Wiredit_dist_pom_ACF, com_info_com_par Wiredit_inded_ACF, mental_sup Wiredit_ACF, creent_sup Wiredit_ACF, creent_sup Wiredit	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X69 X77 X72 X74 X72 X73 X74 X75 X75 X75 X75 X75 X75 X75 X75 X75 X75	Wire_init_weight_ACG det_inderw_ACG Wiat_underw ALG feet_nom_hat_ACG Wiat_underw ALG feet_nom_hat_ACG Wisbay_born_ACG type_com_ACG Wisbay_born_ACG type_com_ACG Wyre_mom_ACG pre_birth_inde_ACG Wyre_tow_ACG feet_init_inde_ACG Wyre_tow_ACG com_step_hat Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ Wisbad_uter_admovid_step_ monitor_com_sup_hcp_ monitor_com_sup_hcp_ monitor_com_sup_hcp_ monitor_post_info_com_para monitor_post_info_com_para monitor_post_info_com_para monitor_post_info_com_para monitor_refer_therapist	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X70 X72 X72 X71 X72 X72 X73 X74 X75 X77 X75 X77 X77 X77 X77 X77 X77 X77	Wire_init_weight_ACL (deinderw_ALC           Wiat_underw_ALC, feet_nom_hart_ALC           Wate_underw_ALC, feet_nom_hart_ALC           Wate_underw_ALC, feet_nom_hart_ALC           Wate_underw_ALC, pre_birth_infe,ALC           Wyre_mom_ALC, gre_birth_infe,ALC           Wyre_mom_ALC, enderwirt_ALC           Wyre_mom_ALC, enderwirt_ALC           Wyre_mom_ALC, enderwirt_ALC           Wyreat_undat_ALC, enderwirt_AUC           Wyreat_undat_ALC, enderwirt_AUC     <	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X67 X68 X70 X70 X71 X72 X74 X75 X74 X75 X75 X76 X77 X75 X76 X77 X75 X76 X77 X76 X77 X76 X77 X78 X81 X81 X82 X83 X84 X83 X84 X83 X84 X83 X84 X83 X84 X85 X85 X85 X85 X85 X85 X85 X85 X85 X85	Wire_jurtweight_ACL (d=underwALC           Wire_underw_ALC (d=underwALC           Wisto_underw_ALC (refernomhire_ALC           Wisto_underw_ALC (refernomhire_ALC           Wisto_underw_ALC (refernomhire_ALC           Wisto_underw_ALC (refernomhire_ALC           Wisto_underw_ALC (refer_nomhire_ALC           Wisto_underw_ALC (refer_nomhire_ALC           Wisto_underw_ALC (refer_nomhire_ALC           Wisto_underw_ALC (refer_nomhire_ALC           Wisto_underw_ALC (refer_nomhire_ALC           Wisto_underw_ALC (refer_nomhire_compar           Wistord_underw_ALC (refer_nomhire_compar           Wistord_underw_ALC (refer_nomhire_compar           Wistord_underw_ALC (refer_nomhire_compar           Wistord_underw_ALC (refer_nomhire_compar           Wistord_underw_ALC (refer_nomhire_compar           Wistord_underw_ALC (refer_lasup           Wirefer_momther_ALC (refer_therapist           Wirefer_momther_ALC (refer_therapist           monitorcom_suphcp_1           monitorcomsuphcp_2           monitorcomsuphcp_2           monitorcom_suphcp_1           monitorcomsupthensup_3           monitorcom_supthensup_3           monitorcom_supthensup_3           monitorcom_supthensup_3 <t< td=""><td>0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5</td></t<>	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63         X64           X64         X65           X66         X67           X66         X67           X67         X63           X77         X72           X73         X73           X75         X75           X76         X77           X77         X78           X79         X78           X81         X83           X82         X83           X83         X85           X84         X85           X83         X86           X91         X92           X93         X93           X94         X94           X95         X94	Wire_init_weight_ACL det_inderw_ALC Wiat_underw ALC teat_inde_inde_iACL Wiat_underw ALC teat_inde_iACL Wise_underw ALC teat_inde_iACL Wise_underw ALC teat_inde_iACL Wise_underw ALC teat_inde_iACL Wire_e_iACL type_com_ALC Wired_iACL enterwise Wired_iACL enterwise Wired_iACL enterwise Wired_iACL post_info_com_par Wired_iACL post_info_com_par Mired_iACL post_info_com_par Mired_iACL post_info_com_par Mired_iACL post_info_com_par Mired_iACL post_info_com_par Mired_iACL post_info_com_pars monitor_com_sup_hcp_ monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_mental_sups monitor_mental_sups monitor_mental_sups monitor_mental_sups monitor_mental_sups monitor_mental_sups	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X64 X65 X67 X66 X67 X66 X70 X70 X72	Wire_init_weight_ACL det_inderw_ALC Wire_init_weight_ACL det_inderw_ALC Wist_underw_ALC refer_mom_hire_ALC Wist_underw_ALC refer_mom_hire_ALC Wist_underw_ALC refer_mom_hire Wist_underw_ALC refer_mom_hire Wired_init_add_ALC rep_init_info Wired_init_dat_ALC on_sup_hop Wired_init_dat_ALC cons_sup_hop Wired_init_dat_ALC cons_init_init_com_par Wired_init_ALC rep_init_init_com_par Wired_init_ALC rep_init_init_com_par Wired_init_ALC rep_init_init_com_par Wired_init_ALC rep_init_ALC repara Wired_init_ALC reparameter Wired_init_ALC reparameter Wired	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63         X64           X64         X65           X66         X67           X66         X69           X70         X71           X72         X73           X73         X74           X75         X75           X77         X72           X78         X75           X79         X74           X79         X75           X80         X82           X81         X82           X82         X83           X82         X84           X82         X84           X82         X84           X83         X84           X83         X85           X84         X89           X83         X84           X84         X85           X85         X86           X94         X92           X94         X94           X95         X94           X95         X94           X95         X94	Wire_init_weight_ACL det_inderw_ALC Wire_init_weight_ACL det_inderw_ALC Wist_underw ALC reach_dat_sup_mom_ALC Wisty_pom_ALC repre_ton_MarkAC Wisty_pom_ALC repre_ton_ALC Wire_init_dat_ALC repre_ton_ALC Wire_init_dat_ALC cons_sup_hop Wireach_dat_sup_mom_ALC cons_sup_hop monitor_pre_birth_info monitor_cons_sup_hcp_ monitor_cons_sup_hcp_ monitor_cons_sup_hcp_ monitor_mental_sup_s monitor_mental_sup	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63         X64           X64         X65           X66         X66           X65         X67           X66         X63           X70         X71           X72         X73           X74         X72           X75         X74           X76         X75           X77         X72           X78         X78           X83         X83           X83         X83           X84         X83           X85         X867           X84         X890           X91         X92           X93         X94           X94         X92           X93         X94           X97         X94           X92         X94	Wire_init_weight_ACL det_inderw_ALC Wire_init_weight_ACL det_inderw_ALC Wise_underw_ALC teach_dat_sup_mom_ALC Wise_underw_ALC teach_dat_sup_mom_ALC Wise_underw_ALC teach_dat_sup_mom_ALC Wire_mom_ALC pre_birth_Infe Wire_tow_ALC teach_dat_sup_mom_ALC Wire_tow_ALC teach_dat_sup_mom_ALC Wire_tow_ALC teach_dat_sup_mom_ALC Wire_tow_ALC teach_dat_sup_mom_ALC teach Wire_tow_ALC teach_dat_sup_mom_ALC teach Wire_tow_ALC teach_dat_sup_mom_ALC teach Wire_tow_ALC teach_dat_sup_mom_ALC teach Wire_tow_ALC teach_dat_sup_mom_ALC teach Wirest_dat_sup_mom_ALC teach_Infe_com_par Wirest_dat_sup_mom_ALC teach_Infe_com_par Wirest_dat_sup_mom_ALC teach_Infe_com_par Wirest_dat_sup_mom_ALC teach_sup Wirest_dat_sup_mom_ALC teach_sup monitor_cacknowl_fats monitor_com_sup_hcps monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_mental_sups monitor_mental_sups monitor_mental_sups monitor_top.sup Wirest_dat_sup_top monitor_top.sup Wirest_dat_sup_top Mirest_dat_sup_top Wirest_dat_sup_top Wirest_dat_sup_top Wirest_dat_sup_top Wirest_dat_sup_top Wirest_dat_sup_top Wirest_dat_sup_top Mirest_dat_sup_top Mirest_dat_sup_top Mirest_dat_sup_top Mirest_dat_sup_top Mirest_dat_sup_top Mirest_dat_sup_top teach Wirest_dat_sup_top teach Wirest_dat_sup_tow teach Wirest_dat_sup_top teac	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63           X64           X65           X66           X65           X66           X67           X68           X70           X71           X72           X74           X75           X74           X75           X74           X75           X76           X77           X78           X79           X80           X81           X82           X83           X84           X85           X80           X81           X82           X83           X84           X85           X80           X91           X92           X93           X94           X95           X97           X98           X97           X98           X93           X94           X95           X97           X98           X99           X91           X92	Wire_birt_weight_ACL det_underw_ALC           Wire_birt_weight_ACL det_underw_ALC           Wist_underw.ALC reach_dat_up_mom_ALC           Wisty_underw.ALC reach_dat_up_mom_ALC           Wisted_udd_usp_mom_ALC rom_sup_htp           Wisted_udd_usp_mom_ALC rom_sup_htp           Wisted_udd_usp_mom_ALC rom_sup_htp           Wisted_udd_usp_mom_ALC rom_sup_htp           Wisted_udd_usp_mom_ALC remetal_sup           Wisted_udd_usp_mom_ALC remetal_sup           Wisted_udd_usp_mom_ALC remetal_sup           Wisted_udd_udd_prom_the_pat_mot_sup           Wisted_udd_udd_prom_the_pat_mot_sup           Wisted_udd_udd_prom_the_pat_mot_sup           Wisted_udd_udd_prom_the_pat_mot_sup           Wisted_udd_udd_prom_the_pat_mot_sup           Wister_mot_the_aLC remetal_sup           Wister_mot_the_aLC remetal_sup           Wister_mot_the_aLC remetal_sup           Wister_mot_the_aLC remetal_sup           Wister_mot_the_aLC remetal_sup           Wister_mot_the_aLC remetal_sup           Wister_mot_the_aLC remetal_su	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X67 X66 X67 X70 X72 X72 X73 X73 X74 X73 X75 X75 X76 X77 X76 X77 X78 X75 X76 X77 X78 X75 X76 X77 X78 X79 X79 X79 X79 X81 X82 X82 X82 X82 X82 X82 X82 X82 X82 X82	Wire_init_weight_ACC det_inderw_ACC Wire_init_weight_ACC det_inderw_ACC Wist_underw AIC teach_dat_spi_mom_AC Wist_underw AIC teach_dat_spi_mom_AC Wistor_John_ACC type_com_ACC Wyre_init_dat_AIC type_com_AC Wyre_init_dat_AIC com_Sup_hop Wistor_Aid_aid_spi_mom_AIC, schowl_fat Wistor_Aid_aid_spi_mom_AIC, schowl_fat Wistor_Aid_aid_spi_mom_AIC, schowl_fat Wistor_Aid_aid_spi_mom_AIC, schowl_fat Wistor_Aid_aid_spi_mom_AIC, schowl_fat Wistor_Aid_aid_spi_mom_AIC, schowl_fat Wistor_Aid_AIC, post_info_com_par Wistor_Aid_AIC, post_info_com_par Wistor_Aid_AIC, mental_sup Wistor_Aid_AIC, mental_sup Mistor_Aid_AIC, mental_sup Mistor_Aid_AIC, mental_sup monitor_Dost_info_com_pars_ monitor_Dost_info_com_pars_ monitor_mental_sups_ monitor_mental_sups_ monitor_mental_sups_ monitor_mental_sups_ Mistor_Aid_AIC, f_ schor_Isia Wishint_wistor_AIC, f_ schor_Isia Wishint_wistor_AIC, f_ schor_Isia Wishint_Wistor_AIC, f_ schor_Isia Wishint_Wistor_AIC, f_ schor_Isia Mistor_AIC, f_ schor_Isia	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63           X64           X64           X65           X66           X67           X68           X70           X71           X72           X73           X74           X75           X76           X77           X72           X73           X74           X75           X76           X77           X78           X78           X83           X83           X84           X85           X86           X87           X88           X89           X91           X92           X93           X93           X100           X102	Wire_init_weight_ACG det_inderw_ACC Wire_init_weight_ACG det_inderw_ACC Wist_underw_ACG refer_mom_hit_ACC Wist_underw_ACG refer_mom_hit_ACC Wist_underw_ACG refer_mom_hit_ACG Wist_underw_ACG refer_mom_hit_ACG Wire_init_init_Refer_det_init_ACG Wire_init_init_Refer_det_init_ACG Wire_init_init_Refer_det_init_ACG Wire_init_init_Refer_det_init_ACG Wire_init_init_Refer_det_init_ACG Wire_init_init_ACG post_Info_com_par Wiresch_idad_sup_mom_ACG consup_hop Wiresch_idad_sup_mom_ACG mental_sup Wiresch_idad_sup_mom_ACG mental_sup Miresch_idad_sup_mom_ACG mental_sup Miresch_idad_sup_mom_ACG mental_sup Miresch_idad_sup_mom_ACG mental_sup Miresch_idad_sup_mom_ACG mental_sup Miresch_idad_sup_mom_ACG mental_sup monitor_post_info_com_para monitor_post_info_com_para monitor_mental_supa monitor_mental_supa monitor_mental_supa monitor_mental_supa monitor_mental_supa Miresch_idad_sup Wir_accd_idat_det_idat_idat_E Wiresch_idat_sup	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63 X64 X65 X66 X66 X67 X69 X69 X70 X72 X73 X74 X73 X73 X74 X75 X75 X75 X75 X75 X75 X75 X75 X75 X75	Wire_init_weight_ACG de_underw_ACC Wire_underw_ACG refer_mom_het_ACC Wiselw_inderw_ACG refer_mom_het_ACC Wiselw_inderw_ACG refer_mom_het_ACC Wiselw_inderw_ACG refer_mom_het_ACC Wire_mom_ACG pre_birth_inde_ACC Wire_cont_ACC cont_sup_het Wiread_unders_ache.cont_sup_het Wiread_unders_mom_ACG cont_sup_het Wiread_unders_mom_ACG cont_sup Wiread_unders_mom_ACG cont_sup Wiread_unders_mom_ACG cont_sup Wiread_unders_mom_ACG cont_sup Wiread_unders_mom_ACG cont_sup Wiread_unders_mom_ACG cont_sup Wiread_unders_mom_ACG cont_sup Wiread_unders_mom_ACG cont_sup Wiread_unders_mom_ACG cont_sup monitor_pre_birth_info monitor_pre_birth_info monitor_montal_sup monitor_montal_sup monitor_montal_sup monitor_montal_supa Wireat_sub_ext_	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63         X64           X64         X65           X66         X67           X66         X67           X63         X67           X70         X71           X72         X73           X73         X74           X75         X75           X74         X76           X77         X78           X83         X83           X83         X83           X83         X83           X84         X82           X85         X86           X84         X85           X85         X86           X86         X86           X85         X86           X86         X87           X86         X89           X93         X92           X93         X100           X1001         X102	Wire_init_weight_ACL det_inderw_ALC Wire_init_weight_ACL det_inderw_ALC Wist_underw_ALC teach_dat_sup_mom_ALC Wist_underw_ALC teach_dat_sup_mom_ALC Wisto_John_ALC type_con_ALC Wire_mom_ALC pre_birth_Info Worlin_dat_ALC, acknowl_AL Wired_inder_aLC pre_birth_Info Wired_inder_aLC com_sup_hap Wired_inder_aLC com_sup_hap Wired_inder_aLC post_Info_com_per Wired_inder_aLC post_Info_com_per Wired_inder_aLC com_Info_com_per Wired_inder_aLC com_Info_com_per monitor_acknowl_fats monitor_com_sup_hcps monitor_com_sup_hcps monitor_com_pars_ monitor_com_pars_ monitor_com_pars_ monitor_mental_sups monitor_mental_sups monitor_mental_sups monitor_mental_sups monitor_mental_sups monitor_mental_sups Mired_inder_L_E, det_risk_inder_L Wired_inder_L_E, det_risk_inder_L Wired_inder_L, teach_inder_L Wired_inder_L, teach_inder_L W	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63           X64           X64           X65           X67           X68           X67           X63           X67           X63           X70           X71           X72           X74           X75           X74           X75           X76           X77           X78           X79           X80           X81           X82           X83           X84           X85           X82           X83           X84           X85           X86           X93           X94           X95           X96           X93           X94           X95           X100           X101           X102           X103           X104	Wire_init_weight_ACL det_inderw_ALC Wire_init_weight_ACL det_inderw_ALC Wist_underw.ALC reach_dat_up_mom_ALC Wistpy_Dorn_ALC type_com_ALC Wistpy_Dorn_ALC type_com_ALC Wire_com_ALC pre_birth_Inde Wired_inder_aLC com_sup_hon Wired_inder_aLC com_sup_hon Wired_inder_aLC com_sup_hon Wired_inder_aLC com_sup_hon Wired_inder_aLC com_inder Wired_inder_aLC com_inder Wired_inder_aLC com_inder Wired_inder_aLC com_inder Wired_inder_aLC com_inder Wired_inder_aLC com_inder Wired_inder_aLC com_inder Wireder_inder_aLC com_inder wonitor_post_info_com_parsi wonitor_mental_sups wonitor_mental_sups wonitor_mental_sups wonitor_wiredia_inder Wireder_inder_inder_aLC com_inder Wireder_inder_inder_aLC com_inder Wireder_inderwired_inder_aLC com_inder Wireder_inderwired_inder_aLC com_inder Wireder_inderwired_inder_aLC com_inder Wireder_inderwired_inder_aLC com_inder Wireder_inderwired_inder_aLC com_inder Wireder_inderwired_inder_aLC com_inder Wireder_inderwired_inder_aLC com_inder Wireder_inderwired_inder_aLC com_inder Wireder_inderwired_inder_aLC com_inder W	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63           X64           X64           X64           X65           X66           X63           X63           X65           X65           X65           X65           X65           X67           X72           X73           X74           X75           X75           X76           X77           X75           X76           X77           X72           X75           X76           X77           X72           X81           X82           X82           X83           X84           X82           X83           X84           X82           X83           X84           X85           X84           X85           X94           X92           X94           X92           X94           X92           X100           X102	Wire_init_weight_ACG det_inderw_ACC Wire_init_weight_ACG det_inderw_ACC Wist_underw AIC feat_man_init_ACC Wist_underw AIC feat_man_init_ACC Wist_underw AIC feat_man_init_ACC Wist_underw AIC feat_man_init_ACC Wire_init_ACC rep_init_Info Wireinit_dat_AIC com_sup_hap Wireinit_dat_AIC com_sup_hap Wireinit_dat_AIC com_sup_hap Wireinit_dat_AIC com_sup_hap Wireinit_dat_AIC com_sup_hap Wireinit_dat_AIC com_sup_hap Wireinit_Add_AIC com_sup_hap Wireinit_Add_AIC com_sup_hap Wireinit_Add_AIC com_sup_hap Wireinit_Add_AIC com_sup_hap Wireinit_Add_AIC com_sup_hap Wireinit_Add_AIC com_sup_hap Wireinit_Add_AIC com_sup_hap Wireinit_AIC refer therapist Wireinit_Add_AIC mental_sup Wireinit_Add_AIC mental_sup Wireinit_AIC refer therapist Wireinit_Add_AIC mental_sup Wireinit_AIC refer therapist monitor_com_sup_hap monitor_com_sup_hap monitor_com_sup_hap monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ Mirt_AIC wire [.et _ris_inval_E Wireinitinitinit_AIC refer Wireinititinitinitinitinititinitinitinit_	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5
X63           X64           X64           X65           X67           X68           X67           X69           X70           X71           X72           X73           X74           X75           X74           X75           X74           X75           X74           X75           X74           X75           X77           X74           X75           X77           X78           X82           X83           X84           X85           X86           X86           X87           X88           X89           X91           X92           X100           X1001           X102           X103           X104           X105	Wire_init_weight_ACG det_inderw_ACG Wist_underw.ACG feet_mom_het_ACG Wist_underw.ACG feet_mom_het_ACG Wistyp_mom_ACG pre_birth_inde_ACG Wistyp_mom_ACG pre_birth_inde Wister_inderw.ACG feet_mom_het Wister_inderw.ACG feet_mom_het Wisterw.ACG feet_mom_het Wis	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5

# Table 35Role Matrix for Case (d) for ms – Speed Factors.

	iv - initial values	1
K <sub>1</sub>	type_mom artificiality_birth	0
√2 ≺3	epidural_used	0
K4	deliv_baby	0
K5 K-	baby_born	0
κ <sub>7</sub>	PPPD	0
<8	kid_devel	0
K9 ✓	pre_birth_info	0
<10 ≺11	fat_ask_sup_com	0
<12	fat_rec_sup_com	0
×13	post_info_com_par	0
K <sub>14</sub> K <sub>15</sub>	mental sup	0
K16	acknowl_fat	0
K <sub>17</sub>	age	1
18 K10	dilation mom	0.2
<20	premature_birth	1
<21	type_com	0
K <sub>22</sub> Kan	retention	0
<23 <24	stress	0
<25	birth_dev	0
<26	fear_level	0
×27 <28	ask_sup	0
< <sub>29</sub>	birth_dev_det <sub>HCP</sub>	0
( <sub>30</sub>	det_risk_level <sub>HCP</sub>	0
31	calm_dad <sub>HCP</sub>	0
< <sub>33</sub>	irr_birth_weight <sub>HCP</sub>	0
K34	det_underw <sub>HCP</sub>	0
<35 (	refer_mom_ther <sub>HCP</sub>	0
\36 < <sub>9.7</sub>	baby born <sub>HCP</sub>	0
< <sub>38</sub>	type_com <sub>HCP</sub>	0
K39	type_mom <sub>HCP</sub>	0
40 (41	birth dev det <sub>aic</sub>	0
K42	det_risk_level <sub>Aic</sub>	0
< <sub>43</sub>	encourage_mom <sub>AIC</sub>	0
(44 (46	calm_dad <sub>Alc</sub>	0
45 (46	det_underwaic	0
( <sub>47</sub>	refer_mom_ther <sub>AIC</sub>	0
K <sub>48</sub>	teach_dad_sup_mom <sub>AIC</sub>	0
49 (50	type com <sub>AIC</sub>	0
< <sub>51</sub>	type_mom <sub>AIC</sub>	0
< <sub>52</sub>	pre_birth_info <sub>AIC</sub>	0
K53 K54	W birth_dev_det_HCP, det_risk_level_HCP W det_rick_level_HCP approximate_mem_HCP	0
-54 (55	Wdet_risk_level_HCP, calm_dad_HCP	0
< <sub>56</sub>	Wirr_birth_weight_HCP, det_underw_HCP	0
K <sub>57</sub>	Wdet_underw_HCP, refer_mom_ther_HCP	0
∿58 ≺59	Wedet_underw_HCP, teach_dad_sup_mom_HCP Webby born HCP, type com HCP	0
<	Wtype_mom_HCP, pre_birth_info_HCP	0
K <sub>61</sub>	Wbirth_dev_det_AIC, det_risk_level_AIC	0
62 (63	W det_risk_level_AIC, encourage_mom_AIC	0
K <sub>64</sub>	Wirr_birth_weight_AIC, det_underw_AIC	0
K <sub>65</sub>	W_det_underw_AIC, refer_mom_ther_AIC	0
< <sub>66</sub>	Wdet_underw_AIC, teach_dad_sup_mom_AIC	0
< <sub>68</sub>	Wtype_mom_AIC, pre_birth_info_AIC	0
< <sub>69</sub>	Wpre_birth_info_AIC, pre_birth_info	0
( <sub>70</sub>	Wcalm_dad_AIC, acknowl_fat	0
71 (72	W teach_dad_sup_mom_AIC, acknowl_fat	0
< <sub>73</sub>	Wteach_dad_sup_mom_AIC, com_sup_hcp	0
K <sub>74</sub>	Wcalm_dad_AIC, post_info_com_par	0
75	VV teach_dad_sup_mom_AIC, post_info_com_par	0
< <sub>76</sub>	Wencourage mom AIC post info com par	0
< <sub>76</sub> < <sub>77</sub>	Wencourage_mom_AIC, post_info_com_par Wrefer_mom_ther_AIC, refer_therapist	0
< <sub>76</sub> < <sub>77</sub> < <sub>78</sub>	Wencourage_mom_AIC, post_info_com_par Wrefer_mom_ther_AIC, refer_therapist Wcalm_dad_AIC, mental_sup	0
< <sub>76</sub> < <sub>77</sub> < <sub>78</sub> < <sub>79</sub>	Wencourage_mom_AIC, post_info_com_par Wrefer_mom_ther_AIC, refer_therapist Wcalm_dad_AIC, mental_sup Wteach_dad_sup_mom_AIC, mental_sup	0 0 0
< <sub>76</sub> < <sub>77</sub> < <sub>78</sub> < <sub>79</sub> < <sub>80</sub> < <sub>81</sub>	Wencourage_mom_AIC, post_info_com_par Wrofer_mom_ther_AIC, refer_therapist Wealm_ddal_AC, mental_sup Wteach_ddal_sup_mom_AIC, mental_sup Wencourage_mom_AIC, mental_sup Wrefer_mom_ther_AIC, mental_sup	0 0 0 0
K76 K77 K78 K80 K81 K82	Wencoursge_mom_AC, post_Infg_com_par Wrefer_mom_ther_AC, refer_therapist Wcalm_dda,DC, mental_sup Weach_dda,DC, mental_sup Wencoursge_mom_AIC, mental_sup Wrefer_mom_ther_AC, mental_sup Wrefer_mom_ther_AC, mental_sup	0 0 0 0 0 0
K76 K77 K78 K80 K81 K82 K83	Wencourage_mont_ACL post_infs_com_par Wencer_mont_ther_ACL refer_therapits Wencer_gen_dALC mental_sup Wiesed_ided_sup_mont_ACL mental_sup Wencourage_mont_ther_ACL mental_sup Wright_mont_ACL remetal_sup Wright_mont_ACL remetal_sup monitor_pre_bitth_info	
K76 K77 K78 K80 K81 K82 K83 K83 K84 K83 K84 K84 K84	Wencourage_mont_ACL post_Infs_com_par Werker_mont_ther_ACL refer_therapikt Werker_mont_therations Wissel_datk_montal_sup Wencourage_mont_ACL mental_sup Wencourage_mont_ACL mental_sup Wencourage_mont_ACL mental_sup monitor_pre_birth_info monitor_acknowl_fats	
K76 K77 K80 K81 K82 K83 K84 K85 K86 K86	Wencourage_mon_ACL post_Info_com_par Wrater_mon_ther_AIC, rater_therapist Wisclan_dod_AIC, mental_sup Wisclan_dod_AIC, mental_sup Wisclan_dod_AIC, mental_sup Wencourage_mon_AIC, mental_sup Wispe_com_AIC, type_com monitor_per_birth_info monitor_acknowl_fat_ monitor_acknowl_fat_ monitor_acknowl_fat_	
576 578 578 580 581 583 583 583 583 583 583 584 585 584 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Wencourage, mont_AIC, post_Info_com_par Werder_mont_Info_AIC, refer_therapist Werder_mont_Info_AIC, mental_sup Wencourage_mont_AIC, mental_sup Wencourage_mont_AIC, mental_sup Wright_mont_AIC, type_com monitor_pre_bitth_info monitor_acknowl_fats monitor_acknowl_fats monitor_acknowl_fats monitor_com_sup_hcps	
576 578 578 580 581 583 583 583 583 584 585 585 584 585 584 588 588 588 588	Wenderurgen_mont_ACL post_Infe_com_par Werder_mom_ther_ACL refer_therapist Werder_mom_ther_ACL refer_therapist Werder_add_ktc:mental_sup Wenderurge_mont_ACL mental_sup Wrege_mont_ACL mental_sup Wrege_mont_ACL remetal_sup Wrege_mont_ACL remetal_sup Mrege_mont_ACL remetal_sup monitor_pre_bitth_info monitor_acknowl_fat_ monitor_acknowl_fat_ monitor_com_sup_hcp_ monitor_post_info_com_par_ monitor_post_info_com_par_	
575 577 579 581 581 582 583 583 583 583 583 583 583 583 583 583	Wencourage_mont_ACL post_Infs_com_par Wiefer_mont_ther_ACL refer_therapid Wieder_dad_ACE mental_sup Wieder_dad_ACE mental_sup Wieder_mont_ACE mental_sup Wencourage_mont_ACE mental_sup Wrops_com_ACL mental_sup Wrops_com_ACL mental_sup monitor_acknowl_fat_ monitor_acknowl_fat_ monitor_com_sup_hcp_ monitor_com_sup_hcp_ monitor_post_info_com_par_ monitor_post_info_com_par_	
476 477 480 480 482 482 482 483 485 485 486 486 489 489 489 489 489 489 489 489 489 489	Wencourage_mont_ACL post_Infs_com_par Wiefer_mont_ther_ACL refer_therapist Wieder_dad_ACE_mental_sup Wieder_dad_ACE_mental_sup Wencourage_mont_ACE_mental_sup Wencourage_mont_ACE_mental_sup Wiefer_mont_ther_ACL remains_up Wiefer_mont_ther_ACL remains_up monitor_pre_birth_info monitor_acknowl_fats monitor_com_sup_hcp1 monitor_com_sup_hcp2 monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_refer_therapist	
476 477 479 480 482 483 483 483 485 485 486 485 488 485 488 489 489 489 489 489 489 489 489 489	Wendourage_ment_ACL post_infs_com_par Wendourage_ment_ACL refer_therapist Wendourage_ALC mental_sup Windourage_ment_ACL mental_sup Wendourage_ment_ACL mental_sup Wendourage_ment_ACL mental_sup Wrege_ment_ACL yemest monitor_pre_bitth_info monitor_acknowl_fats_ monitor_acknowl_fats_ monitor_com_sup_hcp1 monitor_post_info_com_par; monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_mental_sups	
× <sub>76</sub> × <sub>77</sub> × <sub>79</sub> × <sub>80</sub> × <sub>81</sub> × <sub>82</sub> × <sub>83</sub> × <sub>84</sub> × <sub>85</sub> ×	Wenderurgen_mont_ACL post_infic_com_par Werder_mom_ther_ACL refer_therapist Werder_mom_ther_ACL refer_therapist Werder_add_star_mort_ACL mental_sup Werder_amon_tACL mental_sup Wrype_com_ACL remetal_sup Wrype_com_ACL remetal_sup Wrype_com_ACL remetal_sup Mrype_com_ACL remetal_sup monitor_acknowl_fat_ monitor_acknowl_fat_ monitor_com_sup_hcp_ monitor_com_sup_hcp_ monitor_post_info_com_par_ monitor_post_info_com_par_ monitor_refer_therapist monitor_mental_sup_ monitor_mental_sup_	
ζη <sub>6</sub> ζη <sub>7</sub> ζη <sub>8</sub> ζη <sub>8</sub> ζ <sub>84</sub> ζ <sub>85</sub> ζ <sub>85</sub> ζ <sub>86</sub> ζ <sub>86</sub> ζ <sub>86</sub> ζ <sub>86</sub> ζ <sub>87</sub> ζ <sub>87</sub> ζ <sub>86</sub> ζ <sub>87</sub> ζ <sub>87</sub>	Wencourage_mont_ACL post_Infic_com_par Wester_mont_ther_ACL refer_therapid Wester_mont_ther_ACL refer_therapid Wiseter_mont_therapid Wiseter_mont_therapid Wencourage_mont_ACL mental_sup Wrefer_mont_ther_ACL mental_sup Wrefer_mont_ther_ACL mental_sup monitor_acknowl_fats monitor_acknowl_fats monitor_com_sup_hcps monitor_com_sup_hcps monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_refer_therapist monitor_mental_sups monitor_mental_sups monitor_mental_sups	
47 <sub>0</sub> 47 <sub>7</sub> 47 <sub>9</sub> 48 <sub>1</sub> 48 <sub>2</sub> 48 <sub>2</sub> 48 <sub>2</sub> 48 <sub>3</sub> 48 <sub>4</sub> 48 <sub>4</sub>	Wencourage, ment, ALC, post_info.com.par Wirdsr.jone.jither, ALC, refers, Inter-pitst Weisfar_jone.jither, ALC, refers, Inter-pitst Weisfar_jone.jither, ALC, mental_sup Wirdsr.jone.jither, ALC, mental_sup Wirdsr.jone.jither, ALC, mental_sup Wirdsr.jone.jither, ALC, mental_sup Wirdsr.jone.jither, ALC, mental_sup monitor_pre_bitth_info monitor_pre_bitth_info monitor_pre_bitth_info monitor_pre_bitth_info monitor_prest_info_com_pars; monitor_post_info_com_pars; monitor_post_info_com_pars; monitor_mental_sups monitor_mental_sups monitor_mental_sups monitor_mental_sup4 monitor_type_com	
47 <sub>0</sub> 47 <sub>1</sub> 47 <sub>2</sub> 47 <sub>2</sub> 48 <sub>3</sub> 48 <sub>4</sub> 48 <sub>4</sub>	Wenderugger, emen, AC, post_infe_com_par Werder_mon_ther_AC, roter_therapist Werder_mon_ther_AC, roter_therapist Werder_ded_ACC mental_sup Wirder_mon_ther_AC, mental_sup Werder_mon_ther_AC, mental_sup Wrape_com_AC, mental_sup Wrape_com_AC, mental_sup Wrape_com_AC, mental_sup monitor_acknowl_fats monitor_acknowl_fats monitor_com_sup_hcp_ monitor_com_sup_hcp_ monitor_post_info_com_pars monitor_post_info_com_pars monitor_mental_sup_	
4γ <sub>10</sub> 4γ <sub>17</sub> 4γ <sub>17</sub> 4γ <sub>19</sub> 4γ	Wenderugenzege_ment_ACL peat_infe_com_par Werder_ment_ACL refer_therapist Werder_ment_ACL refer_therapist Werder_ment_ACL metal_sup Wirder_ment_ACL metal_sup Werderugence Wrige_com_ACL metal_sup Wrige_com_ACL metal_sup Wrige_com_ACL metal_sup Wrige_com_ACL metal_sup monitor_acknowl_fat_ monitor_acknowl_fat_ monitor_acknowl_fat_ monitor_com_sup_hcp_ monitor_com_sup_hcp_ monitor_com_sup_hcp_ monitor_com_sup_hcp_ monitor_post_info_com_par_ monitor_post_info_com_par_ monitor_metal_sup_ monitor_metal_sup_ monitor_metal_sup_ monitor_metal_sup_ monitor_metal_sup_ monitor_metal_sup_ monitor_metal_sup_ monitor_metal_sup_ monitor_metal_sup_ monitor_metal_sup_ Wirk_dcw_upc con_feedback Wirktor_educ_for_isk_level_E	
4γ <sub>0</sub> 4γ <sub>10</sub> 4γ <sub>2</sub> 4γ <sub>2</sub> 4γ <sub>3</sub> 4γ <sub>4</sub>	Wencourage_mon_ACL post_infs_com_par Wencourage_mon_ther_ACL refer_therapian Wencourage_mon_ther_ACL metral_sup Wencourage_mon_ACL mental_sup Wencourage_mon_ACL mental_sup Wrips_com_ACL (post_sup monitor_acknowl_fat_ monitor_acknowl_fat_ monitor_com_sup_hcp_ monitor_com_sup_hcp_ monitor_post_info_com_par_ monitor_post_info_com_par_ monitor_post_info_com_par_ monitor_refer_therapist monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ monitor_mental_sup_ Wunk_cw_utcp con_feedback	
4γ <sub>10</sub> 4γ <sub>12</sub> 4γ <sub>12</sub> 4γ <sub>12</sub> 4γ <sub>12</sub> 4 <sub>12</sub>	Wencourage, men, ALC, post_infs_com_par Werker_men_ther_ALC_refer_therapits Werker_men_ther_ALC_refer_therapits Werker_men_ther_ALC_mental_sup Wencourage_mon_ther_MLC_mental_sup Werker_men_ther_ALC_mental_sup Werker_men_ther_ALC_mental_sup Werker_men_ther_ALC_mental_sup monitor_pre_birth_info monitor_cknowl_fats monitor_ccom_sup_hcps monitor_com_sup_hcps monitor_post_info_com_pars monitor_post_info_com_pars monitor_post_info_com_pars monitor_mental_sup	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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Fig. B1. Adequate Communication.



Fig. B2. Ineffective Communication.

mental model, results in optimal current knowledge.

Lastly, the strong influence of proper communication depicted in the models is not limited to the potential they depict of communication within the childbirth process. The perspective can be extended to other medical practices, which increasingly facilitates a safety culture, where open communication lies at the center.

# 9. Limitations and further work

This research has potential limitations. Given the nature of the research focusing mainly on actions that can be taken to reduce paternal postpartum depression, overcompensation may be a factor. Specifically, the bias of centering the model around necessary communication for father, may have restricted the realistic scope of the communication

actions for the mother while assigning too much emphasis on those actions for the father only.

During modeling, various aspects were not discussed, for instance, how communication may influence the stress or engagement levels, while considering all the actors. Similarly, how communication can play its role in overcoming the related fears is not addressed. During simulation we only presented for a certain time duration, but, it would be interesting to investigate the impacts of communication for a longer time, i.e., when parents leave the hospital. Moreover, how equilibrium for certain states (e.g., stress or asking for support), may influence states of postpartum depression for longer time is not presented in this study.

The available literature on risk factors and intervention methods to combat paternal postpartum depression is not very extensive. Some states selected for the model are based on desires that fathers have



Fig. B3. Role of Virtual Coach.

expressed without their effectiveness being studied scientifically and determined to be successful. In future, we aim to collect more multidisciplinary information, which may help researchers to provide some analytical grounds to study the effectiveness of the modeled states. A possible improvement on this, could be conducting a study based on the Edinburgh Postpartum Depressive Scale (EPDS) and applying the values to the model created. The model is created in such a way, that does not depend on a precise definition, and it is not limited to one notion. This allows for a large application scope within the AI Coach Project.

Also, we aim to extend our model, in terms of responses of healthcare practitioners toward father and toward the virtual safety coach. In the future, we also would like to study multiple factors (e.g., culture, family structure or affiliations) regarding communication during the childbirth process (Dunkel Schetter et al., 2016; Goodman, 2004). Moreover, an extension including the support during the prepartum period, would add to the effectiveness of communication in reducing the risk of postpartum depression. This stems from the fact, that developing depression is not limited to after giving birth. In addition, a relevant point that was not discussed in the scope of this paper, is it could help parents who previously suffer from depressive episodes.

We also aim to extend the monitoring. Some world states had incoming connections from multiple mental model end states. In the models, this may have resulted in only one of these end states being activated, as one may be sufficient to pass the chosen threshold determining activation, which allows for some but not the maximum possible support.

Learning is a time-consuming task not only for individuals but also for the HCP and AIC. Therefore, in a real-world setting, this would allow for emphasis to be applied on having certain mental process over others. For example, having only post-birth communication may be as effective in decreasing the risk of PPPD as all the other states combined. This would allow for an adequate learning pace for practitioners in the field without overwhelming them regarding vast additional knowledge. Similarly, this could be applied to the AIC teaching the HCP in steps (based on importance), rather than all at once. By doing so, the level of retention of the information could be higher. Moreover, studying the aspect of trust towards AIC can also add a value while discussing the levels of communication.

In this study, the Coach (AIC) is modeled to be activated without a

permission from the actors on the floor. To implement it with the current mental model into a healthcare setting, one would have to ensure high specificity and high sensitivity of the AIC. This would avoid eliciting negative emotions in the father with a false positive of, for example, a deviation occurring. A trigger initiated from the HCP could activate the Coach would be beneficial.

In the real-world, the virtual AI Coach can be considered a facility to assist healthcare practitioners. Therefore, the coach could have a different model (i.e., not similar to HCP). In this study, the virtual AI Coach is trying to monitor if communication is needed. That might be possible by analyzing the conversations or through some sensors. However, then the coach should be empathetic enough to provide support to the father. Moreover, without a trigger, it would be still questionable if the coach receives enough input to decide on whether to communicate or not in terms of accuracy and time. Lastly, how communication provided by Virtual Safety Coach will be evaluated by all the actors, is also to be considered as a future work for this research study.

# **Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

# Data availability

Data will be made available on request.

# Acknowledgements

This research is part of the SAFECoach Project, which aims to create an AI based coach to serve hospital organization. The main aim of this coach is to assist healthcare practitioner while considering mental models and shared mental models for its implementation.

# Appendix A. Role matrices for all model variants

Role matrices are the numerical representations of the simulations.

They provide full information about the network characteristics of the model variants. Below all role matrices for the models are visible, with each state having its own row, on which each incoming connections, as well as their impact, is specified. Moreover, they are color coordinated based on the level that the states lie on. See below.

A1 Healthcare Practitioner communicates with Father

For full specification see: Tables 6, 7, 8, 9, 10 and 11 A2 Lack of Communication with Father For full specification see: Tables 12, 13, 14, 15, 16 and 17 A3 Role of Virtual Safety Coach For full specification see: Tables 18, 19, 20, 21, 22 and 23 A4 Dynamic Monitoring of Virtual Safety Coach For full specification see: Tables 24, 25, 26, 27, 28 and 29 A5 Organizational Learning and its Influence For full specification see: Table 30, 31, 32, 33, 34 and 35

# Appendix B. Simulation results in the software designed for the Virtual Coach

As the coach is implemented by the Python environment, the Matlabgenerated simulation results have been reproduced; see examples below. They are exactly similar to the simulations by the Matlab software, which provides additional verification.

B1 Adequate CommunicationSee Fig. B1.B2 Ineffective CommunicationSee Fig. B2.B3 Role of Virtual CoachSee Fig. B3.

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