New TOEH+P Framework for the Adoption of Smart Patient Management System Strategies at an IVF (In Vitro Fertilization) Program Provider Hospital in Central Java Province

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1. Introduction

IVF (In Vitro Fertilization) program is an embryo breeding process in the laboratory which is obtained from the fertilization of an egg cell by sperm outside the body (in vitro) and followed by an embryo transfer process. IVF program in Indonesia, has been around since 1988. One important factor determining the success of an IVF program is the age factor and the age success rate of IVF patients ≤ 35 years is 40% [1].

Not all IVF patients who are initially declared pregnant, will succeed until the delivery process, about 17% of IVF patients miscarry [2]. The level of infertility in Indonesia is around 12% - 22% of the total population of reproductive age, the rate of female infertility in Indonesia reaches 15%, or about 6 million Indonesian women who experience infertility or have reproductive problems [3].

The success rate of IVF programs in Indonesia is still low, which is around 29% and the achievement is the same as the achievement of the international IVF program of 25-30% [3].

Anxiety is one of the factors causing failure of the IVF program. Anxiety in pregnant women adversely affects the health of pregnant women and their fetuses [4]. 77.7% of IVF patients who take the IVF program have a high level of anxiety, 83.3% of IVF patients experience IVF program failure [5].

Good communication between doctors and patients can reduce the level of anxiety of pregnant women.

Results of previous research, high-quality doctor-patient online communication, positive impact on improving the quality of health care and patient health outcomes.[6].

The research of Akhan Akbulut et al about intelligent systems prediction of the health of pregnant women and fetuses get an accuracy rate of 87.5%, the results of this research show that intelligent systems have good reliability in the health sector. This smart system has an important role to give early recommendations to pregnant women before seeing a doctor, so that the mother does not panic and can take preventative measures that help maintain the health of the pregnant woman and her fetus [7].

The combination of doctor-patient online communication and the ability of an intelligent system into an intelligent system for handling IVF patients post embryo transfer, can help IVF patients overcome anxiety. But the ability of the smart system is not optimal if the process of adopting the smart system in the hospital experiences a disruption or failure. Having the right adoption strategy is the first and important step before implementing the smart system.

This study uses the TOEH framework which is a recommendation framework for the process of adopting health information systems in hospitals [8]. The differentiator of this study from before was adding patient variables to the TOEH framework. Use triangulation research to get results with good

Abstract: 77.7% of IVF patients have high levels of anxiety. To reduce the level of anxiety of IVF patients, hospitals and IVF patients need an intelligent system for handling IVF patients post embryo transfer. The combination of the TOEH framework and patient variables, the new TOEH+P framework becomes the strategy and indicator of assessing the readiness of the hospital before implementing the smart system.

Keywords: TOEH Framework, Patients, TOEH+P Framework, Strategy

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credibility. The object of this study is an IVF service provider hospital in Central Java province.

2. Literature Review

2.1. Adoption of Innovation

Results of research conducted by Hossein Ahmadi et al, the process of adopting information technology innovation before applying it to the hospital, is a very important factor. Selection of the right innovation adoption strategy, provide benefits for hospitals, in the form of improving the quality and performance of hospital services [9]. Research continues Hossein Ahmadi et al (2017), adding the benefits of implementing cost savings [8].

2.2. TOEH Framework

Innovation adoption framework is a guideline for hospital management in assessing and evaluating the readiness of hospitals to apply innovation. The adoption framework will show some variables that are ready and variables that are not ready to accept the process of adopting innovation, so that hospital management can take action in anticipation.

Research by Hossein Ahmadi et al (2015), get the most important variables that need to be considered in adopting innovation, that is: staff competency is the most important variable in the human dimension, the profit gained by the hospital is the most important variable in the technological dimension, the size of the hospital is the most important variable in the organizational dimension and government policy is the most important variable in the environmental dimension. In some cases, there are several other variables that are considered by organizations in adopting information technology innovations, that is: compatibility variable, top management support variable and information system infrastructure variable [9].

Further research Hossein Ahmad et al get results that confirm the results of previous studies. Variables in the technological dimension are the advantages of innovation received by hospitals, high compatibility with existing systems and hospital information system security. The variable in the organizational dimension is the size of the hospital. The variable on the environmental dimension is the pressure from competitors. Variables on the human dimension are the availability of human resources who master the technology and the level of staff knowledge [8].

The variables of the research results of Hossein Ahmadi et al, become the variables that complement the innovation adoption framework, called the TOEH framework, as shown in fig 1:

3. Research Methodology

3.1. Triangulation Research

Triangulation research is a mixed research between quantitative and qualitative research. Triangulation research examines similarities and differences in the same object [10]. There are three results in triangulation research [11]:

- Convergence, which is getting the same results from different methods, so as to increase the credibility of the research.
- Complementarity, which is getting complementary results.
- Divergence, which is getting different results and using these differences as the next research opportunity.

3.2. Hypothesis

Hypothesis 1: Graffigna et al research results reveal that one of the success factors in implementing innovation is the involvement of patients in the system [12]. This study conducts testing to determine whether IVF patients have an influence on the intelligent system of handling IVF patients after embryo transfer.

Ho : There is no significant influence of IVF patients to the intelligent system of handling IVF patients post embryo transfer.

Ha : There is a significant influence of IVF patients to the intelligent system of handling IVF patients post embryo transfer.

3.3. Conceptual Framework

Conceptual framework in Fig 2, is a reference to complete this research.
4. Findings and Discussions

4.1. Hypothesis test

Questionnaires were distributed to the jewel-hearted tough combat community using Google Forms for 1 week. The questionnaire was responded to by 17 community members. Data is processed and validated using SPSS software.

The Cronbach’s Alpha value for the IVF patient variable is 0.794, so the IVF patient variable is declared reliable. The IVF patient variable becomes a predictor variable, as shown in table 1, table 2 and table 3:

Table 1. Variables Entered/Removed

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables Entered</th>
<th>Variables Removed</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IVF PATIENTS</td>
<td></td>
<td>Enter</td>
</tr>
</tbody>
</table>

a. Dependent Variable: SMART SYSTEM
b. All requested variables entered.

d. Dependent Variable: SMART SYSTEM

Table 2. Summary Model

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.631a</td>
<td>.398</td>
<td>.357</td>
<td>.691</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), IVF PATIENTS
b. Dependent Variable: SMART SYSTEM

Table 3. Anova Test

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Regression</td>
<td>4,725</td>
<td>1</td>
<td>4,725</td>
<td>9,902</td>
<td>0.0075</td>
</tr>
<tr>
<td>Residual</td>
<td>7,157</td>
<td>15</td>
<td>.477</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11,882</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: SMART SYSTEM
b. Predictors: (Constant), IVF PATIENTS

Column F in table 3, has a value of 9,902 and a significance level of 0.007 <0.005. The results state that ho reject is significant, it means that there is a significant influence on the variables of IVF patients to the intelligent system of handling IVF patients after embryo transfer. The IVF patient variable becomes an additional variable to the TOEH framework, so it is called the new TOEH + P framework as shown in Fig 3:

Fig 3. TOEH+P Framework

4.2. Triangulation Research Results

4.2.1. Interview result

The variables in the new TOEH + P framework are guidelines for compiling a list of questions. The interviewees came from an IVF service provider hospital in Central Java province. There are three resource persons, namely hospital leaders as resource 1 (N1), hospital fertility doctors as resource 2 (N2) and hospital information technology staff as resource 3 (N3). Interviews are conducted at different times and days. The recapitulation of results is shown in table 4:

Table 4. Interview Results of Three Resource Persons

<table>
<thead>
<tr>
<th>No.</th>
<th>The questions</th>
<th>Interview Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. **Benefits of innovation for hospitals** (Dimensions of Technology)
   Are the benefits of innovation obtained by the hospital into consideration before deciding to adopt an innovation?

2. **High compatibility** (Dimensions of Technology)
   Is the high compatibility between innovation and existing systems in the hospital a consideration before deciding to adopt an innovation?

3. **Information technology security level** (Dimensions of Technology)
   Is the security level of innovation a consideration before deciding to adopt an innovation?

4. **Availability of information technology infrastructure** (Organizational Dimensions)
   Is the availability of infrastructure a consideration before deciding to adopt an innovation?

5. **Management Support** (Organizational Dimensions)
   Is management support taken into consideration before deciding to adopt innovation?

6. **Hospital size** (Organizational Dimensions)
   Is the type of hospital a consideration before deciding to adopt an innovation?

7. **Pressure from competitors** (Environmental Dimension)
   Are competitors considered before deciding to adopt innovation?

8. **Pressure from the government** (Environmental Dimension)
   Is government pressure taken into consideration before deciding to adopt innovation?

9. **The availability of staff who have competencies in information technology** (Human Dimensions)
   Is the availability of hospital staff who have competence in innovation a consideration before deciding to adopt innovation?

10. **Staff knowledge level about information technology** (Human Dimension)
    Is the level of hospital staff’s knowledge of innovation taken into consideration before deciding to adopt innovation?

11. **Patients**
    Are the needs and desires of patients taken into consideration before deciding to adopt innovation?

All three informants delivered the same results, so it was stated that the results of this interview had good credibility. To complete the results of the interviews, observation and literature study activities were carried out.

**4.2.2. Observation and Literature Study Results**

Observations were carried out in conjunction with interview activities at the hospital. Literature study is done by studying relevant data in cyberspace. The results of observations and literature studies are shown in table 5:

<table>
<thead>
<tr>
<th>No.</th>
<th>The questions</th>
<th>Observation and Literature Study Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Benefits of innovation for hospitals (Dimensions of Technology)</td>
<td>The monitoring results found the fact that the hospital has implemented several innovations that benefit the hospital and patients:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The official website of</td>
</tr>
</tbody>
</table>
the hospital
- Online service system for patient registration
- Online service system to check room availability for inpatients
- Online service system to get the queue number of polyclinic patients

<table>
<thead>
<tr>
<th>2. High compatibility (Dimensions of Technology)</th>
<th>3. Information technology security level (Dimensions of Technology)</th>
<th>4. Availability of information technology infrastructure (Organizational Dimensions)</th>
<th>5. Management Support (Organizational Dimensions)</th>
<th>6. Hospital size (Organizational Dimensions)</th>
<th>7. Pressure from competitors (Environmental Dimension)</th>
<th>8. Pressure from the government (Environmental Dimension)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No supporting data obtained.</td>
<td>Some government regulations require hospitals to prioritize the level of security of the information technology used:</td>
<td>Some government regulations require hospitals to provide adequate infrastructure for the information technology used:</td>
<td>Government Regulation No. 46 of 2014 concerning Health Information Systems, article 45 paragraph 1 and paragraph 2 [15].</td>
<td>Regulation of the Minister of Health of the Republic of Indonesia No. 340 / Menkes / Per / III / 2010 concerning Hospital Classification which contains consequences that must be met by all types of hospitals [16].</td>
<td>There are several hospitals that provide IVF services:</td>
<td>Some government regulations require hospitals to implement information technology:</td>
</tr>
<tr>
<td></td>
<td>- Regulation of the Minister of Health of the Republic of Indonesia No. 269 / Menkes / Per / III / 2008 concerning Medical Records, article 14 [13].</td>
<td>- Regulation of the Minister of Health of the Republic of Indonesia No. 82 of 2013 concerning Hospital Management Information System, article 7 [14].</td>
<td></td>
<td></td>
<td>- In the province of Central Java, there are 3 private hospitals and 2 government hospitals that provide IVF program services, namely: Telogorejo Hospital, RSI Sultan Agung, RSIA Gladiol, RSUP Dr. Kariadi (Amarils Infertility Clinic) and RSUD Dr. Moewardi (Sekar Fertility Clinic)</td>
<td>- Regulation of the Minister of Health of the Republic of Indonesia No. 82 of 2013 concerning Hospital Management Information System, article 3 paragraph 1 and article 4 paragraph 1 [14].</td>
</tr>
<tr>
<td></td>
<td>- Regulation of the Minister of Health of the Republic of Indonesia No. 82 of 2013 concerning Hospital Management Information System, article 7 [14].</td>
<td>- Republic of Indonesia Government Regulation No. 46 of 2014 concerning Health Information Systems, article 45 paragraph 1 and paragraph 2 [15].</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9. The availability of staff who have competencies in information technology (Human Dimensions)

- The results of monitoring found the facts, the hospital service section had utilized a computer-based information system.
- After accessing the hospital's website and entering the patient registration online service link, the response is fast and in accordance with the evidence in the field.

10. Staff knowledge level about information technology (Human Dimension)

After accessing the hospital website, a fertility blog link was obtained which is managed independently by a fertility doctor and assisted by a team of nurses. These results indicate that hospital fertility doctors and nursing teams have good competence to take advantage of advances in information technology that help their work.

11. Patients

- The results of recapitulation of the questionnaire by Google Form: 53% of IVF patients expressed strongly agree and 35% of IVF patients agreed that if an intelligent system of handling IVF patients post embryo transfer was able to answer all IVF patients' questions quickly and accurately.

4.3. Strategi Adopsi Sistem Cerdas Penanganan Pasien IVF Pasca Embrio Transfer

The results of this study prove that to have the right strategy in implementing an intelligent system of handling IVF patients after embryo transfer in a hospital must involve eleven variables of the TOEH+P framework:

1. The innovation benefits that the hospital receives.
2. High compatibility between innovation and systems that already exist in hospitals.
3. Safety level of innovation.
4. Infrastructure availability.
5. Management support.
6. Hospital type.
7. Hospital competitor.
9. The availability of hospital staff who have competence towards innovation.
10. The level of hospital staff's knowledge of innovation.
11. Patient's needs and wants.

Eleven new TOEH + P framework variables are indicators for hospital management to evaluate the readiness of hospitals in implementing intelligent systems for handling IVF patients in hospitals.

5. Conclusions, Limitations and Suggestions

Variables in the new TOEH + P framework are used as strategies or assessing the readiness of hospitals to implement intelligent systems for handling IVF patients.

Eleven new framework variables TOEH+P: innovation benefits, high compatibility, security level, infrastructure availability, management support, type of hospital, hospital competitor, government regulations, availability of staff who have the appropriate competence, staff's level of knowledge on innovation, needs and wants of patients.

This research is a limitation, because the testing of the new TOEH + P framework was only carried out at an IVF service provider hospital in the province of Central Java.

Future studies can test the new TOEH+P framework in several hospitals in Indonesia that provide IVF services, both private and government...
hospitals, so that the new TOEH+P framework validation process.

6. References


