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Research Article

MATERNAL AND FETAL FACTORS ASSOCIATED WITH MISOPROSTOL USE IN MUBENDE REGIONAL REFERRAL HOSPITAL, UGANDA

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Abstract: *There are numerous obstetric uses for misoprostol. It mimics the normal labor process by causing the uterus to contract strongly and by softening and dilating the cervix. This action makes it uterotonic. The maternal uses include cervical ripening, initiating labor, treating incomplete abortions, preventing, and treating postpartum haemorrhage, and causing abortions. This study sought to identify maternal and fetal risk factors related to misoprostol use among mothers who gave birth at the regional referral hospital in Mubende. A mixed-method analytical cross-sectional design was used with mothers, their infants, and healthcare professionals. 385 respondents made up the sample. Interviews, observation, and the review of documents were used to gather the data. 12.4% of mothers had ever used misoprostol. In comparison to mothers who lived in rural areas, urban mothers were two times more likely to have a positive history of misoprostol usage (COR=1.843, 95% CI (0.903-3.763)). Mothers with a parity of 2–4 had a 0.5x lower likelihood of using misoprostol [COR=0.514, 95% CI (0.166–1.595)]. Better APGAR scores of 4-7 (4 times) and 8-10 (2 times) in newborns were associated with a higher likelihood of a positive history of misoprostol use. In conclusion, misoprostol use poses dangers to both the mother and the fetus, necessitating careful observance.*

Keywords: *Misoprostol, Misoprostol use, Parity, Mubende Regional Referral Hospital, Uganda*

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1. Introduction

1.1. Background of the Study

Misoprostol is a synthetic prostaglandin E1 analog that also softens and dilates the cervical mucosa in addition to causing uterine contractions. This drug may be administered orally, vaginally, recto-rectally, buccally, or sublingually [1]. Misoprostol is used off-label for a number of indications in the practice of obstetrics and gynecology [2-4]. These indications encompass but are not limited to, medications for abortion, medical care of miscarriage, labor induction, cervical ripening prior to surgical procedures, and postpartum haemorrhage treatment. Due to its wide range of uses in the area of reproductive health, misoprostol is listed on the WHO Model List of Essential Medicines. Misoprostol causes uterine contractions, cervical softening and dilating, nausea, vomiting, diarrhea, fever, and chills, all of which are dose-dependent [1]. Unsafe abortions and postpartum haemorrhage continue to be the two main causes of maternal mortality worldwide, according to the results of a study that looked at the use of misoprostol in community settings to lower the risk of postpartum haemorrhage. To reduce maternal mortality among women who have limited access to skilled birth attendants, educating community-based birth attendants to administer misoprostol to prevent postpartum haemorrhage

showed promise for success. Therefore, it was believed that the introduction of misoprostol, a generic, low-cost, heat-stable, tablet-form uterotonic, would revolutionize the prevention and treatment of the two leading causes of death in women of reproductive age: postpartum haemorrhage (commonly known as PPH) and unsafe abortion. Misoprostol was found to be both risk-free and efficient in preventing both indications. Following popular acceptance of this viewpoint, Zambia started giving out misoprostol at prenatal appointments in 2010 to help avoid postpartum haemorrhage [5].

According to studies, postpartum haemorrhage (PPH) and unsafe abortions are the two main causes of death for women of reproductive age. Misoprostol's debut and use could revolutionize how these two conditions are prevented and treated. [1-4]. Misoprostol was found to be both risk-free and efficient in preventing both indications.

According to the results of numerous other researches, misoprostol may be used for a variety of obstetric purposes to treat maternal health-related difficulties [6]. It accomplishes this by acting as a uterotonic, which makes the uterus contract hard and also relaxes and dilates the cervix in a way similar to how labor naturally occurs. It has many uses in terms of maternal health, including the prevention and treatment of postpartum haemorrhage, labor induction, treatment of missed and incomplete abortions, treatment of miscarriage, induced abortion, ripening of the cervical cervix before delivery, and uterine instrumentation. Depending on the underlying medical problem being treated, several dosage regimes are used. For labor induction and cervical softening before birth, the dose can be as low as 25 milligrams; however, the dose must be between 400 and 800 milligrams for other purposes [6].

Misoprostol use, however, might have serious negative effects on the mother and fetus. The WHO investigated the efficacy of using various misoprostol doses due to the lack of adequate data from direct randomized comparisons of these doses. They aggregated the outcomes of trials using each dose of the medicine in order to determine the relative efficacy of two different misoprostol doses. The majority of the trials in that review were carried out in settings where the third stage of labor was regularly actively managed. Five trials reported maternal fatalities [7]. Out of the 11 deaths that were reported in these studies [8], eight (8) were among the misoprostol-treated women (RR: 2.0; 95% CI: 0.68-5.83; Peto OR: 2.49; 95% CI: 0.76-8.13). Six of the eight reported maternal deaths in the misoprostol group were related to postpartum haemorrhage [7].

Results also revealed information on maternal fatalities and serious morbidity as reported in studies comparing the contraceptive misoprostol to placebo or other uterotonics in the prevention or treatment of postpartum haemorrhage. Accordingly, when misoprostol was compared to other uterotonics, a similar number of adverse events were reported in both prevention and treatment trials: in the former, 1 of 32 women in both the treatment and control groups (RR: 1.0; 95% CI: 0.07-15.30); in the latter, 16 of 10281 versus 16 of 10292 women, respectively (RR: 1.0; 95% CI: 0.51-1.96). Both in prevention and treatment trials, where misoprostol was compared to a placebo, there were a few more adverse events reported in the misoprostol group: 8 of 2070 versus 5 of 2032 women, respectively (RR: 1.46; 95% CI: 0.52-4.09); 5 of 196 versus 2 of 202 women, respectively (RR: 2.06; 95% CI: 0.52-8.17).

In another investigation, gaps or limitations in the usage of misoprostol were identified. The discovered shortcomings were grouped into six broad thematic categories, including inconsistency in supplies and their delivery, insufficient staffing, providers' and end users' lack of awareness, the lack of drug registration, and concerns about its usage at the provider and policy level [9]. Three (3) incidences of maternal deaths following misoprostol use were documented in another study. However, in two of the cases, the medication was used to facilitate illegal abortions, while in the third, uterine rupture caused a maternal death after misoprostol was taken clinically to induce labor [10].

In Brazil in 1991, there were 288,700 women who needed hospitalization due to misoprostol-related complications from attempts at abortion. Misoprostol was outlawed in Brazil as a whole by Decree 344/98, which was decided upon by the Ministry of Health, as a result of it being discovered to

cause some congenital defects in newborns. Misoprostol use is carefully controlled and limited to hospitals, where it can only be given while being closely monitored by a doctor. One of the more serious issues that afflict a child who does not have an abortion is damage to the central nervous system, which frequently leads to the congenital anomaly known as Moebius syndrome. A facial look that lacks expression and convergent strabismus are both symptoms of Moebius syndrome. It frequently affects both sides of the face and is brought on by a congenital, non-progressive paralysis of cranial nerves VI and VII [11].

It was previously noted in another study that some patients suffered elevated temperatures of at least 40 degrees Celsius following the administration of misoprostol for the treatment of PPH at doses ranging from 600g to 1000g [7]. According to the results of a Brazilian cohort research on pregnant women who received prenatal care in six state capitals, misoprostol-exposed fetuses had a risk of congenital defect that was 2.74 times greater (95% confidence interval: 1,06-7,05) than that of unexposed fetuses in terms of malformations that were identified at birth. Misoprostol was found to have a significant correlation with congenital abnormalities (OR = 2.64; 95%CI: 1.03-6.75), while sex hormones had a positive correlation with congenital abnormalities (OR = 2.24; 95%CI: 1.06-4.74). According to the research, using sex hormones or misoprostol during pregnancy raises the likelihood of congenital abnormalities [12].

The aim of this study was to investigate the maternal and fetal parameters associated with misoprostol use in Mubende Regional Referral Hospital in light of the information provided above.

1.2. Research Questions

The study was guided by the following research questions

1) What is the proportion of misoprostol use among mothers who were delivered from Mubende regional referral hospital?
2) What are the maternal factors associated with misoprostol use among mothers who were delivered from Mubende regional referral hospital?
3) What are the fetal factors associated with misoprostol use among mothers who were delivered from Mubende regional referral hospital?
4) What are the healthcare provider's experiences with misoprostal use in Mubende regional referral Hospital?

1.3. Conceptual Framework

The study was guided by the conceptual diagram (Figure 1). The outcome, misoprostal use is dictated by the interaction of the independent variables ranging from maternal factors, and fetal factors to health provider experiences with misoprostol.

2. Materials and Methods

2.1. Study Design

The research employed a mixed-method analytical cross-sectional design (both qualitative and quantitative). In a cross-sectional study, data are gathered on the entire study population at one time to explore the link between disease (outcomes) and the other factors of interest is why the researcher chose this design (exposures).

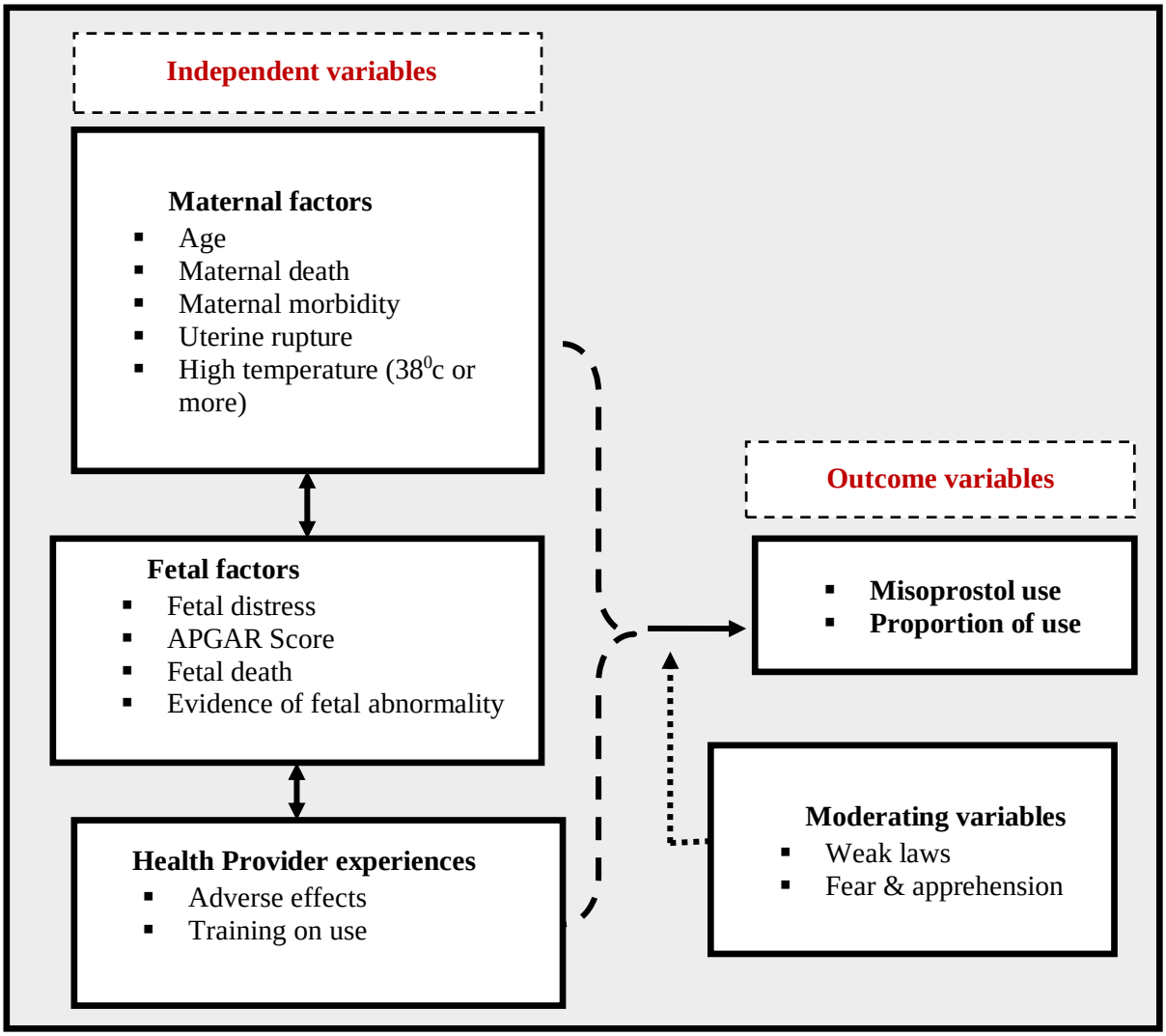

Figure 1. Conceptual Diagram

2.2. The Study Area

Mubende Regional Referral Hospital is in Mubende district in central Uganda, roughly 150 kilometers from Mulago National Referral Hospital. It can accommodate more than 200 beds. It serves the districts of Mityana, Mubende, Luweero, Nakasongola, Nakaseke, Kyankwanzi, Kiboga, and Kasanda as a teaching and regional referral hospital.

Mubende regional referral hospital is one of the over 16 regional referral hospitals supported by the Ugandan Ministry of Health where intern doctors are assigned for additional training by specialists and consultants in medical and surgical fields. The hospital's obstetrics and gynecology department, managed by a consultant obstetrician and gynecologist, treats more than 300 patients and clients per month [13].

2.3. Study Population

The participants in the study included both the mothers and their newborn babies who were delivered at the medical center. Providers of healthcare services were also investigated.

2.4. Eligibility Criteria

All mothers who delivered or babies who were delivered from Mubende regional referral hospital were included and misoprostol use was investigated. All mothers who didn’t deliver from Mubende

regional referral hospital or babies who weren't delivered from Mubende regional referral hospital were excluded from the study.

2.5. Sample Size Estimation

Cochran's formula for calculating sample size (n_0) when the population size (N) is infinite: Cochran (1977) was used [14].

Thus, $n_0 = \frac{Z^2 Pq}{e^2}$

where n_0 is the sample size, z is the specified critical value of desired confidence level, p is the estimated proportion of the attribute in the population = 50%

q= 1 - p

e is the desired level of precision = 5%

Thus; Samples (n_0): $n_0 = \frac{1.96^2 * (0.5) * (1-0.5)}{0.05^2} = \frac{(0.9604)}{(0.0025)}$ = 384.16 = 385 Respondents

Six healthcare providers, working in maternal child health departments were also sampled for qualitative interviews on misoprostol use.

2.6. Sampling Technique and Procedure

Systematic random sampling was used to select the respondents' mothers' patient files with birth information. The first file was ordered serially using a simple random process. Each seventh file was sampled. Repeated until enough samples from mothers and their infants were collected.

For qualitative interviews, six healthcare providers working in maternal child health departments were purposively selected to participate in interviews on misoprostol use.

2.7. Study Variables

Misoprostol use was the dependent (outcome) variable, while the independent variables were maternal factors, fetal factors, and health provider experience.

Age, maternal demise, uterine rupture, and high temperatures were among the maternal variables (38^0C or more). Among the fetal factors were fetal distress, fetal death, and the APGAR score. The experiences of the healthcare practitioners included adverse events and prior misoprostol training. The factors were ineffective laws and apprehension.

2.8. Data Collection Tools and Methods

Document Review Guide (Observation guide) and Interview Guide (for primary data) were used as provided in several studies that have ever used Document Review Guides [15]. On this tool, the kinds of information needed to be taken from each respondent record. This made it easier for the researchers to get the information needed from each patient's record. This Sheet was used as a guide by the researchers to get the right information about each patient.

The qualitative interview guide was also designed for healthcare providers working in the maternal child health department. A set of questions were asked and responses related to misoprostol use were elicited and documented.

2.9. Data Entry, Analysis and Presentation

The SPSS package version 25 was used to process and code the data in accordance with the questions. The study's data were summarized and presented using descriptive statistics, which made use of frequency, tables, charts, and percentages as needed. The data gathered from the interviews with healthcare practitioners was used to establish patterns and linkages within and between categories of data collected.

Qualitative analysis from interviews with healthcare providers was analyzed verbatim.

2.10. Ethical Considerations

The study was approved by the Office of Research Ethics Committee of Mubende Regional Referral Hospital IRB. (Document Number: MRRH/REC/01/15/2019; Date:November 19, 2021). Written informed consent was obtained before enrolling eligible participants into the study. Informed consent was sought, and the consent forms were accessible in English, Luganda, and Runyoro. Confidentiality was maintained.

3. Results

3.1. Background Characteristics of Respondents

Univariate analysis of different background variables was done. The results are shown in Table 1.

Table 1. Background Characteristics of Respondents

Background Variables	n	%
Age in years		
Less than 20 years	80	21.1%
20-40years	298	78.4%
More than 40years	2	0.5%
Education level		
No educ.	262	68.9%
Primary educ.	70	18.4%
Post Primary educ.	32	8.4%
Tertiary educ.	16	4.2%
Residence		
Rural	306	80.5%
Urban	74	19.5%
History of ANC completion		
Completed ANC	320	84.2%
Never completed ANC	60	15.8%
Parity		
Para 1	169	44.5%
Para 2-4	159	41.8%
Para 5+	52	13.7%
Uterine rupture		
Yes	8	2.1%
No	372	97.9%

Table 1 shows that the majority of the respondents 78.4% were aged 20-40 years followed by those aged less than 20 years (21.1%). 68.9% of the respondents had no education followed by those with primary education at 18.4%. 80.5% of the respondents lived in rural areas and most of the respondents completed their antenatal visits (84.2%). Uterine rupture was recorded in 2.1% of the respondents.

3.2. Proportion of Misoprostol Use Among Mothers

The proportion of misoprostol use among mothers who were delivered from Mubende regional referral hospital was determined. Analysis was done using Microsoft Excel and the result is shown in Figure 2 below.

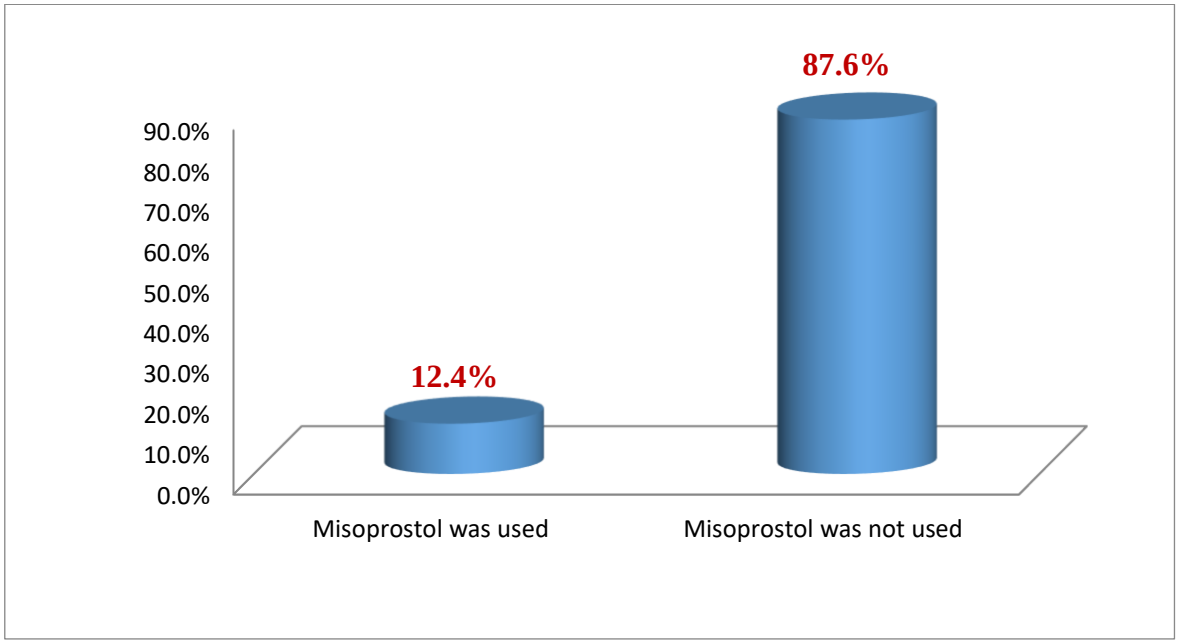

Figure 1. History of Misoprostol Use During Delivery

The study found that misoprostol was used by 47(12.4%) of the mothers during delivery whereas, for the majority 333 (87.6%) of the respondents, misoprostol was not used during their deliveries.

3.3. Maternal Factors Associated with Misoprostol Use Among Mothers

Bivariate regression analysis and cross-tabulation were done to determine the maternal factors associated with misoprostol use among mothers who delivered from Mubende regional referral hospital. The result of the analysis is shown in Table 2.

Table 2. Binary Logistic Regression Analysis of Maternal Factors for Misoprostol Use

Maternal Variables	History of Misoprostol Use		Total	COR, 95% CI(U-L)	P-value
	Used (n=47)	Not used (n=333)			
Age in years					
Less than 20years	8(2.1%)	72(18.9%)	80	Ref	
20-40years	39(10.3%)	259(68.2%)	298	0.778(0.347-1.744)	0.542
More than 40years	0(0.0%)	2(0.5%)	2	-	
Education level					
No educ.	32(8.4%)	230(60.5%)	262	Ref	0.976
Primary educ.	8(2.1%)	62(16.3%)	70	0.800(0.169-3.780)	0.778
Post Primary educ.	5(1.3%)	27(7.1%)	32	0.934(0.175-4.992)	0.937
Tertiary educ.	2(0.5%)	14(3.7%)	16	0.813(0.137-4.823)	0.820
Residence of mothers					
Rural	33(8.7%)	273(71.8%)	306	Ref	
Urban	14(3.7%)	60(15.8%)	76	1.843(0.903-3.763)	0.093

Table 2. Continued

Maternal Variables	History of Misoprostol Use		Total	COR, 95% CI(U-L)	P-value
	Used (n=47)	Not used (n=333)			
History of ANC completion					
Completed ANC	41(10.8%)	279(73.4%)	320	Ref	
Never completed ANC	6(1.6%)	54(14.2%)	60	0.777(0.310-1.951)	0.592
Parity of mothers					
Para 1	24(6.3%)	145(38.2%)	169	Ref	0.485
Para 2-4	19(5.0%)	140(36.8%)	159	0.514(0.166-1.595)	0.249
Para 5+	4(1.1%)	48(12.6%)	52	0.645(0.205-2.022)	0.452
Uterine rupture					
Yes	1(0.3%)	7(1.8%)	8	Ref	
No	46(12.1%)	326(85.8%)	372	0.305(0.023-4.084)	0.369
Co-morbidity					
Yes	1(0.3%)	16(4.2%)	17	Ref	
No	46(12.1%)	317(83.4%)	363	3.965(0.301-52.231)	0.295
History of high temperature					
Yes	0(0.0%)	2(0.5%)	2	Ref	
No	47(12.4%)	331(87.1%)	378	0.000(0.000-0.000)	0.999
Maternal death					
Yes	4(1.1%)	23(6.1%)	27	Ref	
No	43(11.3%)	310(81.6%)	353	0.588(0.174-1.985)	0.392

COR=Crude Odd Ratio, **CI**=Confidence Interval, **U**=Upper, **L**=Lower

Misoprostol was predominantly used on mothers aged 20-40 years (10.3%), with no education (8.3%) and of rural residence (8.7%). Although there was no statistical significance (p=0.093), mothers of urban residence were about 2times more likely to have had a positive history of misoprostol use during delivery [COR=1.843, 95% CI (0.903-3.763)] compared to those of rural residence. Misoprostol was predominantly used on mothers whose parity was one (6.3%) as opposed to those whose parity was more than one. The study found that mothers whose parity lies between 2-4 were 0.5 times less likely to have had misoprostol used during delivery [COR=0.514, 95% CI (0.166-1.595)]. Similarly, mothers whose parity was 5 and above were o.6times less likely to have had misoprostol used during delivery [COR=0.645, 95% CI (0.205-2.022)].

Misoprostol was majorly used on mothers with no co-morbidity (12.1%). The study found that having no co-morbidity was 4times more likely to predispose mothers to misoprostol use in Mubende regional referral hospital [COR=3.965, 95% CI (0.301-52.231)]. Again, mothers who didn't die had more misoprostol use (11.3%) than their counterparts who had maternal death. Most of the mothers who had maternal death (6.1%) didn't have a history of misoprostol use.

In an interview with health workers, the reported observed side effects of misoprostol use ranged from 'Rigors, PPH AND Uterus Rupture' (11.1%) to 'Rigors, Maternal Death AND Uterus Rupture' (33.3%). Other observed side effects were 'Rigors AND Uterus Rupture' (22.2%) and 'PPH AND Uterus Rupture' (33.3%). Only 33.3% of the health workers were adequately trained on the use of misoprostol. When multivariate logistic regression analysis was run, there was no significant finding to report.

3.4. Fetal Factors Associated with Misoprostol Use Among Mothers

Bivariate regression analysis and cross-tabulation were done to determine the fetal factors associated with misoprostol use among mothers who delivered from Mubende regional referral hospital. The result of the analysis is shown in Table 3.

Table 3. Binary Logistic Regression Analysis of Fetal Factors for Misoprostol Use

Fetal Variables	History of Misoprostol Use Used (n=47)	Not used (n=333)	Total	COR, 95% CI(U-L)	P-value
Fetal distress					
Yes	5(1.3%)	20(5.3%)	25	Ref	
No	42(11.1%)	313(82.4%)	355	0.508(0.166-1.557)	0.236
APGAR Score					
0-3	2(0.5%)	34(8.9%)	36	Ref	0.195
4-7	4(1.1%)	49(12.9%)	53	3.932(0.543-28.448)	0.175
8-10	41(10.8%)	250(65.8%)	291	2.043(0.694-6.014)	0.195
Fetal abnormality					
Yes	2(0.5%)	4(1.1%)	6	Ref	
No	45(11.8%)	329(86.6%)	374	0.232(0.033-1.613)	0.140
Fetal death					
Yes	3(0.8%)	34(8.9%)	37	Ref	
No	44(11.6%)	299(78.7%)	343	1.014(0.197-5.214)	0.987

COR=Crude Odd Ratio, **CI**=Confidence Interval, **U**=Upper, **L**=Lower

Of the 25 babies who had fetal distress, only 5(1.3%) had a positive history of misoprostol use during delivery. Babies with no fetal distress were 0.5 times less likely to have had a positive history of misoprostol use during their delivery [COR=0.508, 95% CI (0.166-1.557)]. Babies with better APGAR scores of 4-7 and 8-10 were 4 times and 2 times more likely to have had a positive history of misoprostol use during their deliveries [COR=3.932, 95% CI (0.543-28.448)] and [COR=2.043, 95% CI (0.694-6.014)] respectively. Fetal abnormality was less likely associated with misoprostol use.

Again, when multivariate logistic regression analysis was run, there was no significant finding to report.

3.5. Healthcare Provider Experiences with Misoprostal Use

To determine the healthcare provider experiences with misoprostol use in Mubende regional referral hospital, an interview with six (6) selected healthcare providers was held. In mothers, the reported observed side effects of misoprostol use ranged from 'Rigors, PPH AND Uterus Rupture' (11.1%) to 'Rigors, Maternal Death AND Uterus Rupture' (33.3%). Other observed side effects were 'Rigors AND Uterus Rupture' (22.2%) and 'PPH AND Uterus Rupture' (33.3%). See Figure 3 (a). In newborn babies, the reported observed side effects of misoprostol use ranged from 'IUFD' (11.1%) to 'IUFD and Asphysia' (45%%). See Figure 3 (b).

The study found that only 33.3% of the health workers were adequately trained on the use of misoprostol, presenting poor experience. No observed fetal abnormality was reported by healthcare providers in Mubende regional referral hospital.

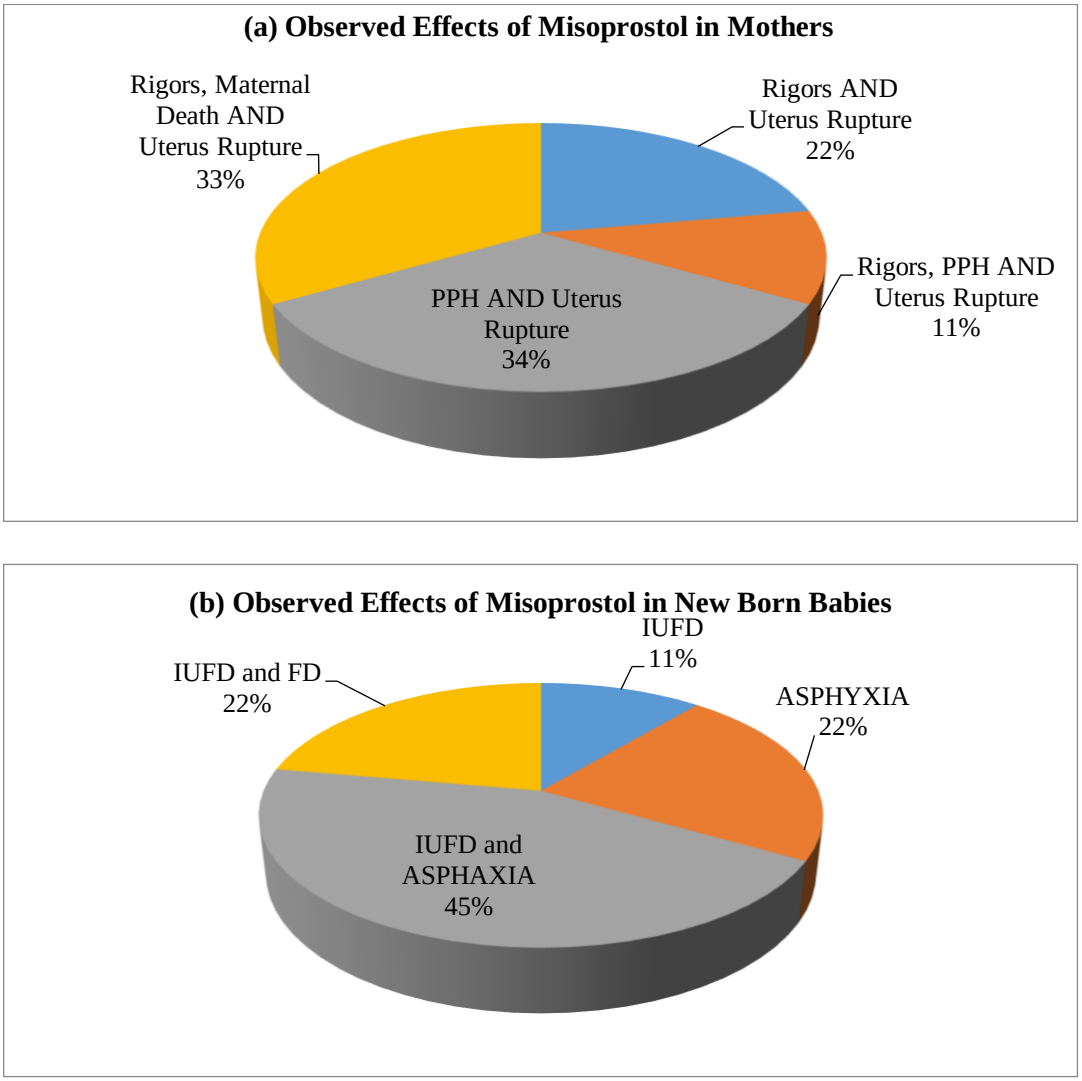

Figure 2. Observed Effects of Misoprostol Use in Mothers & New Born Babies

3.6. Summary of Results

The study found that 12.4% of mothers had previously used misoprostol during childbirth. Although there was no statistical significance (p=0.093), urban mothers were approximately twice as likely as rural mothers to have a positive history of misoprostol use during delivery [COR=1.843, 95% CI (0.903-3.763)]. Misoprostol was predominantly administered to single-parity mothers (6.3%), as opposed to those with multiple births.

The study found that mothers with parity between 2 and 4 were half as likely to have received misoprostol during childbirth [COR=0.514, 95% CI (0.166-1.595)]. Similarly, mothers with a parity of five or more were 0.6% less likely to have used misoprostol during childbirth [COR=0.645, 95% CI (0.205-2.022)]. Misoprostol was predominantly administered to mothers without co-morbidities (12.1%). The study found that the absence of co-morbidities was four times more likely to predispose mothers to misoprostol use at the regional referral hospital in Mubende [COR=3.965, 95% CI (0.301-52.231)]. Again, non-dead mothers had a higher misoprostol usage (11.3%) than their counterparts who experienced maternal mortality. The majority of mothers who experienced maternal death (6.1%) had no history of misoprostol use.

Babies with APGAR scores of 4-7 and 8-10 were 4 and 2 times more likely, respectively, to have a positive history of misoprostol use during delivery [COR=3.932, 95% CI (0.543-28.448) and [COR=2.043, 95% CI (0.694-6.014)].

4. Discussion

4.1. Proportion of Misoprostol Use Among Mothers

According to this study, misoprostol was administered to 47 (12.4%) of the mothers during childbirth. In a recent study to determine maternal outcomes and factors associated with different methods of induction of labour in Zambia [16], misoprostol was used to induce labour in the majority of patients with the vaginal route used by the majority of patients (73.0%).

In a separate study conducted in South West Nigeria, 41 (23.2%) women reported using misoprostol for the first time to induce an abortion [17]. Although few studies have been conducted on the proportion of mothers who use misoprostol, it is evident that its use at the regional referral hospital in Mubende is significantly lower than elsewhere.

4.2. Maternal Factors Associated with Misoprostol Use Among Mothers

In this study, misoprostol was primarily administered to mothers aged 20 to 40 (10.3%), with no formal education (8.3%), and residing in rural areas (8.3%). Although there was no statistical significance (p=0.093), urban mothers were approximately twice as likely as rural mothers to have a positive history of misoprostol use during delivery [COR=1.843, 95% CI (0.903-3.763)]. The study also found that mothers with parity between 2 and 4 were half as likely to have used misoprostol during childbirth. Similarly, mothers with a parity of five or more were 0.6% less likely to have used misoprostol during childbirth [COR=0.645, 95% CI (0.205-2.022)]. Misoprostol was predominantly administered to mothers without co-morbidities (12.1%). A lack of co-morbidity was fourfold more likely to predispose mothers to misoprostol use at the Mubende regional referral hospital [COR=3.965, 95% CI [(0.301-52.231)]]. Adeniyi et al. [18] conducted a study in Nigeria to compare the efficacy of two dosing regimens of vaginal misoprostol for cervical ripening and labour induction (2014). Pregnant women with single, low-risk pregnancies at term were randomly assigned to receive either 25 g or 50 g of vaginal Misoprostol. The group receiving 50 g of Misoprostol experienced more labour complications, including premature labour, tachysystole, and abnormal fetal heart rate changes. In Zambia [16], logistic regression analysis demonstrated that induction of labour (IOL) with misoprostol was associated with maternal age (p 0.001), gravidity (p 0.001), and Parity (p 0.001). In terms of age and parity, there are similarities between this study and a previous one.

4.3. Fetal Factors Associated with Misoprostol Use Among Mothers

In this study, babies born without fetal distress were 0.5 times less likely to have a positive history of misoprostol use during delivery [COR = 0.508, 95% CI = 0.166-1.557%]. Babies with APGAR scores of 4-7 and 8-10 were four- and twofold more likely, respectively, to have a positive history of misoprostol use during delivery. No other comparable study was found to compare with these results.

In this study, fetal abnormality was less likely to be associated with misoprostol use, whereas in Brazil, fetuses exposed to misoprostol had a birth-diagnosed risk of congenital anomaly 2.74 times higher (95% confidence interval [CI]: 1,06-7,05) than those not exposed. Misoprostol was found to be positively associated with congenital anomalies (OR = 2.64; 95%CI: 1.03 to 6.75). Contrary to the findings of the present study, Pizzol et al. [12] found that the use of misoprostol during pregnancy increases the risk of congenital anomalies. Misoprostol is considered a teratogen, according to Allen and O'Brien [2]. Misoprostol exposure during early pregnancy is associated with congenital defects such as

skull defects, bladder exstrophy, arthrogryposis, cranial nerve palsies, facial malformations, terminal transverse limb defects, and Moebius sequence [1, 2]. This result resembles those of a few other studies [19] and those of Orioli and Castillo [20].

4.4. Experiences of Healthcare Professionals with Misoprostal Use

In this study, the adverse effects of misoprostol use in mothers ranged from 'Rigors, PPH AND Uterus Rupture' (11.1% of cases) to 'Rigors, Maternal Death AND Uterus Rupture' (33.3% of cases). 'Rigors AND Uterus Rupture' (22,2%) and 'PPH AND Uterus Rupture' (33,3%) were also observed. The reported adverse effects of misoprostol use in newborns ranged from IUFD (11.1%) to IUFD and Asphyxia (45%). Misoprostol is considered a teratogen [2]. Misoprostol exposure during early pregnancy is associated with congenital defects such as skull defects, bladder exstrophy, arthrogryposis, cranial nerve palsies, facial malformations, terminal transverse limb defects, and Moebius sequence [1]. This result resembles those of Orioli and Castillo [20] and a few other studies [19]. None of these were observed in the current investigation. However, experiences of the effects of misoprostol vary among healthcare providers [19].

5. Conclusion

Even though no congenital abnormalities were observed in this study, this does not negate the fact that misoprostol use may predispose infants to the documented abnormalities. Indeed, misoprostol use poses both maternal and fetal risks, necessitating strict adherence to guideline for use of misoprostol by healthcare professionals who administer this medication. In this study, in an interview with health workers, the reported observed side effects of misoprostol use ranged from ‘Rigors, PPH AND Uterus Rupture’ (11.1%) to ‘Rigors, Maternal Death AND Uterus Rupture’ (33.3%). Other observed side effects were ‘Rigors AND Uterus Rupture’ (22.2%) and ‘PPH AND Uterus Rupture’ (33.3%). Babies with no fetal distress were less likely to have a positive history of misoprostol use during delivery, whereas babies with APGAR scores of 4-7 and 8-10 were four- and twofold more likely to have a positive history of misoprostol use during delivery. Misoprostol use was prevalent among mothers with fewer births.

Additional research is still required on the use of misoprostol. Data related to the study are available with the corresponding author and can be availed on reasonable request.

6. Recommendations

The researcher recommends the following in light of the study's findings:

1) Misoprostol use must be regulated in healthcare facilities by facility managers.
2) Healthcare providers who administer misoprostol to mothers must be more cognizant of the risks posed to both mothers and newborns. Ideally, it should only be used when medically necessary and using the provided guideline for use by the Ministry of Health.
3) Researchers recommend additional research on the use of misoprostol in and outside Uganda in order to bolster the available evidence.

Ethical Statement

The study was approved by the Office of Research Ethics Committee of Mubende Regional Referral Hospital IRB. (Document Number: MRRH/REC/01/15/2019; Date: November 19, 2021). Written informed consent was obtained before enrolling eligible participants into the study. Informed consent was sought, and the consent forms were accessible in English, Luganda, and Runyoro. Confidentiality was maintained.

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Conflict of interest

The authors declare no conflict of interest and declare that there was no external funding for this study

Authors' Contributions

The authors contributed equally to this work.

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Research Article

THE EFFECT OF NURSES' PERCEIVED ORGANIZATIONAL SUPPORT ON ORGANIZATIONAL IDENTIFICATION, JOB STRESS AND INTENTION TO LEAVE

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Abstract: *To maintain quality service in healthcare services, the perceived organizational support is believed to affect the conditions such as nurses feeling whole with their job, keeping the stressors related to the work environment under control, and reducing the number of personnel leaving the job. This descriptive and correlational study investigates the effect of nurses' perceived organizational support on organizational identification, job stress, and intention to leave. The study sample consisted of 226 nurses in Türkiye. Data were collected by 'Personal Information Form', 'Survey of Perceived Organizational Support', 'Organizational Identification Scale' 'A Job Stress Scale-20', and 'Turnover Intention Scale'. Descriptive data, Pearson correlation, and simple linear regression were used to analyze the research data. Perceived organizational support was determined to have a positive moderate relationship with organizational identification ($r=0.437$, $p<0.01$), a strong negative relationship with job stress ($r=-0.636$, $p<0.01$), and a moderate negative relationship with intention to leave ($r= -0.517$, $p<0.01$). Perceived organizational support explained 19% of organizational identification, 23% of the job stress, and 17% of the intention to leave ($p<0.05$). For employees to be able to provide the desired performance following the vision and mission of the organization, it is very important to determine the organizational factors affecting the individual performance of the employees.*

Keywords*: Intention to leave, job stress, nurses, organizational support, organizational identification*

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1. Introduction

The changes in the provision of healthcare services today require the existence of healthcare organizations that are suitable for global conditions, open to change, following technological developments, trying to keep the service quality at the top, and keeping qualified manpower in the organization. It is obvious that healthcare organizations also need employees who would increase the quality of the service, as well as the technological infrastructure they use to maintain their strength with all the changes that occur in the global, social, and political aspects. Therefore, it has become a priority for managers to support their employees and meet their expectations to increase the efficiency of the organizations [1, 2]. For employees to be able to provide the desired performance following the vision and mission of the organization, it is very important to determine the organizational factors affecting the individual performance of the employees. Besides being the majority in numbers as one of the occupational groups involved in the delivery of healthcare services, nurses might be more affected by the events that occur in the work environment due to patient care or many systemic problems in this process because they constantly work in close contact with the patients. The nurses need to be supported by their organizations to make sure that their decisions are adopted by other team members and that the

solution is permanent for them to solve the problems they face in the work environment in the desired way [3].

Eisenberger et al. [4] defined organizational support as the fact that organizational values consider employees and have a quality that increases their happiness. Organizational support reflects the support, interest, commitment, and belief that the organization provides to the employee as a result of the employee's contribution to the organization [5]. The development of perceived organizational support is based on basic socio-emotional needs such as social status, self-esteem, and meaning, as well as the personalization of the organization [6]. A good sense of organizational support creates a strong sense of security and belonging by enabling nurses to perceive the respect, concern, and attention of the organization [7]. The fact that managers provide support to employees and demonstrate positive attitudes and behaviors towards them enables the employees to have organizational identification and increase their performance [1].

Organizational identification plays an important role in shaping attitudes and behaviors toward the job and is considered one of the main conditions for the efficiency of the organization [1, 8]. Organizational identification refers to the identification of employees as part of the organization [8]. Employees with high organizational identification have a lower perception of workload [9] while they are less likely to leave their organizations [10] and more likely to work in line with the goals of their organizations [11]. On the other hand, nurses might likely be exposed to many different stressors due to factors related to the continuous provision of services in healthcare organizations, the nature of the job, working conditions, and the environment. The stress experienced in the work environment may cause the employees to leave their jobs by leading to undesirable effects on their identification and performance [12, 13]. Occupational stress is considered a risk that leads to increased tension in the individual with the deterioration of the supply-demand balance in the work environment [14]. Studies show that the job stress of employees and their intention to leave is reduced when they have a positive perception of organizational support. [2, 6, 15-17]

Previous studies show that organizational support significantly affects nurses [1, 2, 18]. To maintain quality service in healthcare services, the perceived organizational support is believed to affect the conditions like nurses feeling whole with their job, keeping the stressors related to the work environment under control, and reducing the number of personnel leaving the job. Therefore, the findings to be obtained from this research will reveal the level of this effect from the Türkiye perspective; at the same time, it will guide the determination of employee retention strategies in terms of institutional and managerial. This study sought to investigate the effect of nurses' perceived organizational support level on organizational identification, job stress, and intention to leave.

2. Materials and Methods

2.1. Research design and objective

This is a descriptive and correlational study. It was conducted to investigate the effect of nurses' perceived organizational support on organizational identification, job stress, and intention to leave Türkiye. The STROBE guideline was carried out to ensure quality reporting in the study.

2.2. Participants and sample size

The study population consisted of nurses working in public and university hospitals of different sizes in Turkey. The A-priori Sample Size Calculator for Multiple Regression program was used for the sample size estimation of the study and the minimum number of samples to be included in the study for 9 variables was determined as 167 with an effect size of 0.15, a power of 0.95 and a margin of error of 0.05 [19]. Considering the possibility of missing data, it was aimed to reach 217 participants, 30% more

than the minimum sample number. The study sample consisted of 226 nurses who volunteered to participate in the study and completed the data collection forms fully.

2.3. Data Collection Tools

A personal information form was created by the researchers and three different scales were used for the data collection.

Personal information form: A 9-question form, created by the researchers, includes questions about the socio-demographic and professional life information of the participants.

Perceived Organizational Support Survey: The form, developed by Eisenberger et al. [4], whose Turkish validity and reliability studies were conducted by Türe and Yıldırım [20], is used to determine the level of organizational support perceived by the employees. The Turkish version of the unidimensional survey consists of nine items. The score of the five-point Likert-type survey is calculated by dividing the total score by the number of items. The score that can be obtained from the scale varies between 1-5. An increase in the score obtained from the survey indicates that the level of perceived organizational support increases [20]. The Cronbach alpha coefficient of the survey was found to be 0.88 in Türe and Yıldırım's study, while it was 0.81 in this study.

Organizational Identification Scale: The scale, developed by Mael and Ashford [21] and adapted into Turkish by Tak and Aydemir [22], is used to determine the organizational identification level of adults. The unidimensional five-point Likert-type scale consists of six items. The scale is evaluated over the average score and there is no cutoff point on the scale. The lowest score that can be obtained from the scale is 1, and the highest score is 5. As the score obtained from the scale increases, organizational identification also increases [22]. The Cronbach alpha coefficient of the scale was found to be 0.88 in Tak and Aydemir's study, while it was 0.87 in this study.

A Job Stress Scale-20: The scale, developed as the Perceived Stress Scale by Cohen et al.[23], was adapted to Turkish culture by Tatar [24]. It is a unidimensional scale named "A Job Stress Scale-20" and consists of a total of 20 items. The scale, which does not have an opposite item, is applied with a five-point Likert-type evaluation ranging from not at all appropriate (1) to completely appropriate (5). The scale measures the stress levels of employees in their organizations [24]. The Cronbach alpha coefficient of the scale was found to be 0.91 in the study of Tatar, and it was 0.90 in this study.

Turnover Intention Scale: The scale, developed by Mobley et al.[25] and adapted into Turkish by Örücü and Özafşarlıoğlu [26], is used to measure the intention to leave the job in adults. The unidimensional five-point Likert-type scale consists of three items. There is no reverse-scored item in the scale. The scale is evaluated according to the total score, with the lowest score being 3 and the highest score being 15. While a high score indicates that the intention to leave the job increases, a low score indicates that it decreases [26]. The Cronbach alpha coefficient of the scale was found to be 0.90 in the study of Örücü and Özafşarlıoğlu (2013), while it was 0.84 in this study.

2.4. Data Collection Process

The study data were collected through the online form (Google Forms), prepared by the researchers, which was sent to nurses through social media between March 4 and May 15, 2022, after obtaining permission from the Ethics Committee and the Ministry of Health. The first page of the online data collection form included an informed consent form which contained detailed information about the purpose of the study, by whom it would be conducted, how long it would take, how the confidentiality of the data would be ensured, and a statement informing them that they could end their participation in the study whenever they wanted. Only the participants who read this form and agreed to participate in the study were allowed to move on to the next stage and fill out the data collection tools. The average time the participants spent completing the data collection form was about 12 minutes.

2.5. Data analysis

The study data were analyzed using the SPSS (Statistical Package for Social Sciences) 22.0 statistical software program on a total of 226 data. Kolmogorov-Smirnov test was used to test whether the data showed normal distribution and it was found that the data were normally distributed. Number and percentage in the evaluation of descriptive data, the Pearson correlation analysis to evaluate whether there was a relationship between variables, and simple linear regression analysis to examine the effect of numerical variables were used. In all analyses, $p<0.05$ was accepted as the statistical significance value.

2.6. Ethical considerations

The necessary permissions were obtained from the Social and Human Sciences Ethics Committee of Adıyaman University on (24.01.2022-198) and the Scientific Research Platform of the Ministry of Health (29.12.2021-T00-08-28) to carry out the study. Necessary permissions were obtained by e-mail from the authors who conducted validity and reliability studies of the measurement tools to be able to use them in this study. Before the start of the study, information about the purpose, content, and duration of the study was shared with the participants and their informed consent was obtained.

3. Results and Discussion

76.5% of the nurses participating in the study were female, 58.4% were between the ages of 20-30, 56.6% were found to reside in the city and 79.2% had an undergraduate degree. 53.5% of them had an experience between 1 to 5 years, 43.4% were working at public hospitals, 68.6% worked in shifts and 80.5% were staff nurses (Table 1).

Table 1. Nurses Socio-Demographic Characteristics (n:226)

Features	n	%
Gender		
Woman	173	76.5
Male	53	23.5
Age		
20-30	132	58.4
31-40	64	28.3
41 and above	30	13.3
Characteristics of the Living Area		
County	28	12.4
City	128	56.6
Big city	70	31.0
Education Background		
High school/Associate degree	18	8.0
Bachelors degree	179	79.2
Postgraduate	29	12.8
Professional experience		
Less than one year	22	9.7
1-5 years	121	53.5
6-10 years	32	14.2
11-15 years	34	15.1
16 years and above	17	7.5

Table 1. Continued

Features	n	%
Working Institution		
Public Hospital	98	43.4
Training and Research Hospital	86	38.1
University Hospital	42	18.5
Working Unit		
Emergency	53	23.5
Intensive care	47	20.7
Internal Services	55	24.3
Surgical Services	46	20.4
Polyclinics	25	11.1
Work Schedule		
Continuous Daytime	54	23.9
Continuous Night	17	7.5
Shift	155	68.6
Status		
Nurse Manager	9	4.0
Staff Nurse	182	80.5
Polyclinic Nurse	24	10.6
Training Nurse	11	4.9

In this study, nurses' Perceived Organizational Support Questionnaire, Organizational Identification Scale, A Job Stress Scale-20 total score average was 2.89 ± 0.84; 3.39 ± 0.99; 2.94±0.75. The total score of the nurses from the Intention to Leave Scale was 7.47±3.61. (Table 2).

Table 2. The Perceived Organizational Support, Organizational Identification, Job Stress, and Turnover Intention Scales Mean Scores

Scales	$\bar{X}$± SD	Min	Max
Perceived Organizational Support Scale	2.89 ± 0.84	1	4.78
Organizational Identification Scale	3.39 ± 0.99	1	5
Job Stress Scale	2.94± 0.75	1.15	4.70
Turnover Intention Scale	7.47 ± 3.61	3.00	15.00

When the relationship between nurses' perceived organizational support, organizational identification, job stress, and intention to leave, perceived organizational support was determined to have a positive moderate relationship with the organizational identification ($r=.437$, $p<0.01$), a strong negative relationship with the job stress ($r=-.636$, $p<0.01$) and a moderate negative relationship with intention to leave ($r= -.517$, $p<0.01$). There was a weak negative relationship between organizational identification and job stress and intention to leave ($r=-.334$; $r=-.263$, $p <0.01$). Furthermore, a moderate positive relationship was found between job stress and intention to leave ($r=.515$, <0.01) (Table 3).

Table 3. Correlation between Nurses' Perceived Organizational Support, Organizational Identification, Job Stress and Intention to Leave

		Perceived Organizational Support Scale	Organizational Identification Scale	Job Stress Scale	Turnover Intention Scale
Perceived Organizational Support Scale	r	1			
	p				
Organizational Identification Scale	r	.437**	1		
	p	0.000			
Job Stress Scale	r	-.636**	-.334**	1	
	p	0,000	0,000		
Turnover Intention Scale	r	-.517**	-.263**	.515**	1
	p	0.000	0.000	0.000	

** p<0.001, * p<0.05

The simple linear regression model analysis established to investigate the effect of organizational support perceived by nurses on organizational identification was determined to be a statistically significant model (F=54.016, p=0.000), and perceived organizational support explained 19% of organizational identification (p<0.05). The analysis of the simple linear regression model established to investigate the effect of the organizational support perceived by nurses on job stress was a statistically significant model (F=69.102, p=0.000) and the perceived organizational support explained 23% of the job stress (p<0.05). The simple linear regression model analysis established to investigate the effect of the organizational support perceived by nurses on the intention to leave was also a statistically significant model (F=49.046, p=0.000), and the perceived organizational support explained 17% of the intention to leave (p<0.05) (Table 4).

Table 4. The Effect of Nurses' Perceived Organizational Support on Organizational Identification, Job Stress, and Intention to Leave

Dependent Variable	**Independent variable**	**ß**	**Std. Error**	**t**	**p**	**F**	**Model (p)**	**Adjusted R^2**
Organizational Identification	**Constant**	7.865	1.741	4.519	0.000	54.016	0.000	0.191
	Perceived Organizational Support	0.497	0.068	7.350	0.000			
Job Stress	**Constant**	93.600	4.270	21.922	0.000	69.102	0.000	0.232
	Perceived Organizational Support	-1.379	0.166	-8.313	0.000			
Intention to Leave	**Constant**	14.772	1.064	13.882	0.000	49.046	0.000	0.176
	Perceived Organizational Support	-0.290	0.041	-7.003	0.000			

β: Regression Coefficient *p<0.05 DW: Durbin Watson St β: Standardized Regression

In this study, the effect of organizational support perceived by nurses on organizational identification, job stress, and intention to leave was investigated.

The level of organizational support perceived by nurses was determined to be above the average in this study (Table 2). Supportive work environments are the most important factor in creating job satisfaction for nurses and keeping them in the organization, which positively affects the retention and maintenance of manpower in the organization [27]. In addition, organizational support is an important factor that positively affects the organizational identity, cooperation, and emotional commitment of

employees [28]. Therefore, perceived organizational support is believed to have a regulatory and improving effect on the relationship of employees with their organizations.

The level of organizational identification of nurses was determined to be above the average in this study (Table 2). A moderate positive relationship was found between the perceived organizational support of nurses and their organizational identification levels (Table 3) and perceived organizational support explained 19% of organizational identification (Table 4). In line with this finding, it can be said that as the level of organizational support perceived by nurses increases, the level of organizational identification also increases. There are a limited number of studies examining the relationship between perceived organizational support and organizational identification levels in nurses. When these limited studies on the subject were examined, they were found to have similar results to our results and the organizational identification levels of the employees with a high perception of organizational support were also high [1, 29]. In the study conducted by Sevinç Altaş (2021) [30], the organizational support perceived by healthcare professionals was found to have a positive significant effect on organizational identification. When the organizational identification level of the employees is high and strong, they would certainly continue to stay in the organization and contribute to organizational success by making the most appropriate decisions in the best interests of the organization [31, 32]. Qualified manpower is very important in healthcare environments. Therefore, organizations should give importance to the happiness of their employees, make them feel happy to be together, meet their needs for respect and recognition, and strengthen their feelings of identification by being aware of their contributions and providing organizational support. In line with this, it should be ensured that organizations focus on positive work attitudes that would keep qualified manpower in the organization, improve working conditions, create a positive work environment and creation of an environment of trust towards the organization and the manager [30].

The job stress level of nurses was determined to be above the average in this study (Table 2). A strong negative relationship was found between the level of organizational support perceived by nurses and their job stress (Table 3) and perceived organizational support explained 23% of job stress (Table 4). This finding suggests that as the level of perceived organizational support increases, the job stress level decreases. When the results of the studies examining the relationship between perceived organizational support and job stress in nurses were reviewed, there are results revealing a negative relationship between organizational support and job stress [16-18]. In the study conducted by Higazee et al. (2016) [18] found a negative relationship between nurses' job stress and organizational support. As a result of the study conducted by Al-Homayan et al. (2013) [15] determined that organizational support might reduce the negative consequences of job stress on nurses' performance. According to the results of another study conducted by Labrague et al. (2018) [33] to examine the effect of nurses' perceptions of organizational support on job outcomes (organizational commitment, job autonomy, job performance, job satisfaction, job stress, and intention to leave), perceived organizational support was determined not to affect any of the six outcomes in nurses. Although the literature reveals that job stress can be reduced by organizational support, it has been also stated that other demographic and clinical variables that may be related to job stress should be investigated to determine the correct relationship between organizational support and job stress [18]. Making arrangements to improve perceived organizational support, such as developing strategies that would include employee-centered practices in organizations, improving working conditions, making arrangements to reduce workload, strengthening teamwork, providing autonomy, and offering development opportunities [16, 33] can contribute to the reduction of nurses' job stress levels. Since the nurses would feel better in such a work environment, their stress levels would decrease and their relationship with their organizations would be strengthened.

The mean score of the nurses' intention to leave was determined to be at a moderate level in this study (Table 2). A strong negative relationship was found between the level of organizational support

perceived by nurses and their intention to leave (Table 3) and perceived organizational support explained 17% of the intention to leave (Table 4). This finding suggests that as the perceived organizational support level increases, the intention to leave the job decreases. When the studies on the subject were examined, there were results of studies showing a negative relationship between perceived organizational support and intention to leave, and that perceived organizational support explains the intention to leave [17, 34]. In the study conducted by Liu et al. (2018) [2] organizational support explained 13% of the overall variance in intention to leave and was found to be the most important predictor of intention to leave. Also, in the study conducted by Abou Hashish (2017) [17], job satisfaction and intention to leave, perceived organizational support constituted approximately 23% of the explained variance of intention to leave. The results of the studies show that perceived organizational support is one of the important antecedents of intention to leave. It is thought that the fact that nurses observe attitudes and behaviors that increase their perceptions of organizational support such as the effort they spend in the work environment being recognized and their personal development being considered would decrease their intention to leave their jobs by causing them to gain a sense of belonging, increase their commitment to the organization and have more motivation to contribute.

There are some limitations to the research conducted. Since the data of this study, the first of which were collected in a certain period, the data obtained are limited to evaluating the longitudinal effects and the causality of the relationships. Another limitation is the online collection of research data. Although it was tried to reach the nurses working in institutions with different characteristics throughout Turkey, no comment could be made about this because the geographical region was not asked in the data collection form. Another limitation is geographic context. These findings cannot be generalized to other countries since the data collection forms used in the research include questions about the perceptions of the organizational structure and working conditions, which may be affected by social, cultural, and political changes.

4. Conclusion

The perceived organizational support, organizational identification, and job stress scores were found to be above the average, and the intention to leave was found to be close to the average value in this study conducted to examine the effect of nurses' perceived organizational support on organizational identification, job stress and intention to leave. Perceived organizational support has been determined to have a positive relationship with organizational identification and a negative relationship with job stress and intention to leave, and perceived organizational support has significant effects on the explanation of all these three variables.

Considering the increase in the nurse job turnover rate all over the world, retention of qualified manpower in the organization, and the undeniable contributions of the employees in the competition of the organizations, it becomes imperative for organizations that provide healthcare services to consider the factors affecting nurses' work performance and make the necessary improvements. Therefore, developing strategies that would increase perceived organizational support, improve working conditions, establish good governance systems, and allow employees to participate in management would reduce job stress and increase their intention to stay at their current jobs by increasing the level of organizational identification. It is recommended to identify and eliminate the stressors arising from the work environment, strengthen teamwork and communication, and offer training and personal development opportunities for nurses to reveal their potential in the best way.

Ethical statement

The necessary permissions were obtained from the Social and Human Sciences Ethics Committee of Adıyaman University on (24.01.2022-198)

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Conflict of Interest

The authors report no actual or potential conflicts of interest.

Authors contributions

G. E. K.: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Validation, Writing - original draft, Writing - review & editing.
Y. Ç.: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Writing - original draft.
All authors read and approved the final manuscript.

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Research Article

THE EFFECTS OF DIFFERENT POSITIONS ON PHYSIOLOGICAL MEASUREMENT AND PERFUSION INDEX IN PEDIATRIC INTUBATED PATIENTS

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Abstract: *The aim of this study is to determine the effects of four different body positions applied to pediatric intubated patients on physiological variables and perfusion index. The sample of this study, which was conducted as a quasi-experimental study in a single group in a pediatric intensive care unit, consisted of 44 intubated and monitored patients. The patients were given supine, right-lateral, left-lateral, and Semi Fowler positions at intervals of two hours, and each position's measurements were evaluated separately. In the analysis of data, number, percentage, mean, standard deviation, ANOVA, and post-hoc (Tukey HSD) tests were used. Fifty percent of the patients were under 1 year old, 56.8% were male, and the mean patient age was 20.61±21.72 months. Peripheral oxygen saturation, systolic blood pressure, and perfusion index mean values in the supine and Semi Fowler positions given to the patient were found to be statistically significant ($p<0.05$). It was determined that SPO2, systolic blood pressure, and perfusion index values were higher in the semi-fawler position than in the other positions.*

Keywords*: position, pediatric intensive care, physiological parameter, perfusion index.*

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1. Introduction

Pediatric intensive care units (PICU) are units that include patients between the ages of 1 month and 18 who need critical care and require holistic nursing care with a disciplined approach [1]. To ensure patient safety and hemodynamic stability in these units, children are usually restrained and observed in bed-bound conditions. Ineffective position change and limited mobility may cause various vital problems, such as disruption of circadian rhythm, cardiovascular problems, delirium, pressure ulcer development, and ineffective respiratory pattern in the short and long term [2],[3]. Position changes of intensive care patients are among the independent functions and initiatives of nurses. The body position should be changed frequently in the bed to minimise damage from the effects of immobilisation and to ensure patient comfort during the treatment and care process [4]. Studies on the position changes of intensive care patients have reported effects on oxygenation, ventilator-associated pneumonia [5]. and the development of pressure sores [6]. Although supine and prone positions have different effects in mechanically ventilated patients, Ateş et al. (2021), in their study with patients diagnosed with Corona Virüs Disease 19 (COVID-19), stated that the supine and lateral positions, together with the prone position, affected compliance with the treatment [7]. Agustina et al. (2021) stated that the right-lateral position can increase oxygen saturation and respiratory rate based on their study of children under five years of age diagnosed with pneumonia [8]. Studies on position changes in pediatric intensive care units are relatively few, so more studies are needed to evaluate the effects of position changes [9]. Perfusion

index (PI) is the ratio of pulsatile blood circulation in peripheral tissue to non-pulsatile blood circulation measured by non-invasive pulse oximetry [10]. It is stated that changes in blood flow, physical conditions of the environment (such as temperature, coldness), and acid-base balance problems in critically ill patients may affect the peripheral perfusion index [10], [11]. Considering these situations, it is important to monitor the blood pressure, pulse, fever, respiratory rate, peripheral oxygen saturation (SPO2), and perfusion index (PI) after different positions are taken to contribute to the development of more critical follow-up of pediatric patients and nursing care.

Purpose and Hypotheses

The main purpose of this study is to determine the effects of four different body positions applied to pediatric intubated patients on physiological variables and PI. Thus, the following hypotheses were created:

H1: Is there a difference between the physiological effects of different body positions of children on mechanical ventilators?

H2: Is there a difference between the perfusion index effects of different body positions of children on mechanical ventilators?

2. Material and Method

2.1. Study Design

The research was carried out as a quasi-experimental study in a single group.

2.2. Setting and Sample

The research was carried out in the paediatric intensive care unit of a tertiary hospital between September 2021 and January 2022. The sample size was determined as 44 patients with a 95% confidence interval and 0.05% significance level by G*power analysis. Patients who had parental consent and met the inclusion criteria were included in the study. The inclusion criteria were as follows: (1) children aged one month to 15 years, (2) patients who are intubated and followed up with monitoring, (3) patients without signs of acute respiratory distress syndrome (ARDS) or increased intracranial pressure (ICP) and (4) patients who did not have a medical problem that prevented them from being positioned. The exclusion criterion was (1) patients who were extubated during the study.

2.3. Data collection

Demographic data were recorded from patient files, and measurements were recorded via the monitor, pulse oximeter, and fever meter devices. Because the patients formed their own control group in the study, randomization was carried out through a simple random numbers table. From the random number in the selected block, patients who met the research criteria were placed in supine, right-lateral, left-lateral and Semi Fowler positions, with two hours between each position change, and blood pressure, pulse, fever, respiratory rate, SPO2 and PI values were evaluated at the second hour after each position.

2.4. Evaluation of Data

Data were analyzed with SPSS package program 24. In the study, blood pressure, pulse, fever, SPO2, and PI were accepted as dependent variables, whereas the supine, right-lateral, left-lateral, and Semi Fowler positions were considered independent variables. Number, percentage, mean, and standard deviation were used in the descriptive analyses. Post hoc (Tukey HSD) analysis was performed to determine the differences between physiological measurement and PI after the patient's position was given.

2.5. Limitations of the Research

The fact that the data of this study were collected from the same group provides reliability in terms of homogeneity. However, the limitation of the research is that the same person performed the application and measurement. The research results can be generalized to similar patient groups.

2.6. Ethical Statement

Before starting the research, approval was obtained from the ethics committee of the Health Sciences University Gazi Yaşargil Training and Research Hospital (Date: 03.09.2021, Number: 884). Necessary information was given to the parents of the patients, and their consent was obtained in line with their voluntary participation.

3. Results

The mean age of 44 children included in the study was 20.61 ± 21.72 months, the mean duration of being connected to a mechanical ventilator was 4.18 ± 3.39 days, and their mean weight was 9.32 ± 5.19. In addition, it was determined that 50% of the children were under the age of 1, 56.8% were male, and 38.6% were diagnosed with respiratory diseases (Table 1).

Table 1. Introductory Characteristics and Clinical Information of Children

Feature		**Number (n)**	**Percent (%)**
Age	< 1 age	22	50
	1-5 age	17	38.6
	> 5 age	5	11.4
Gender	Female	19	43.2
	Male	25	56.8
Medical diagnosis	Respiratory diseases	17	38.6
	Cardiac diseases	9	20.5
	Metabolic diseases	7	15.9
	Neurological diseases	7	15.9
	Nephrological diseases	3	6.8
	Gastrological diseases	1	2.3
	X±SD	**Minimum**	**Maximum**
Intubation time (days)	4.18 ± 3.39	1	15
Age (month)	20.61 ± 21.72	1	80
Weight	9.32 ± 5.19	3.20	25

Vital signs, SPO2 saturation, and the perfusion index (PI) were measured in different positions of the children through at least three cycles two hours apart. The mean values of the post-position values were compared. There were statistically significant differences between the positions in the mean values of SPO2 saturation (p =0.000), systolic blood pressure (p =0.007), and perfusion index (p =0.000) (Table 2).

Table 2. Comparison of Vital Signs and Perfusion Indices of Different Positions of the Children

	Supine X±SD	**Left lateral X±SD**	**Right lateral X±SD**	**Semi Fowler X±SD**	**P value**
O_2 saturation*	91.88 ± 4.78	94.93 ± 4.36	94.70 ± 4.35	96.72 ± 3.75	.000
Blood pressure (systole)*	92.70 ± 13.76	91.77 ± 13.59	92.04 ± 17.42	100.95 ± 12.03	.007
Blood pressure (diastole)	54.31 ± 7.76	52.93 ± 7.09	52.52 ± 11.91	56.52 ± 6.92	.130
Pulse	138.38 ± 22.84	138.00 ± 22.25	137.72 ± 24.24	139.93 ± 21.71	.970
Fever /Temperature	36.71 ± .48	36.77 ± .45	36.75 ± .49	36.77 ± .40	.945
Respiratory rate	32.75 ± 9.48	33.20 ± 9.82	32.95 ± 9.43	33.40 ± 10.45	.990
Perfusion index*	.81 ± .52	1.08 ± .92	.80 ± .51	1.50 ± .85	.000

*: Tukey test, one of the post hoc tests, was studied.

There was a statistically significant difference between the mean values of the supine position and the right lateral (p =0.014), left lateral (p=0.006), and Semi Fowler (p=0.000) positions for SPO2 saturation, but for the right lateral, left lateral, and Semi Fowler, there was no significant difference between the positions. There was a statistically significant difference between the mean values for blood pressure in the Semi Fowler, right lateral (p=0.021), supine (p=0.038), and left lateral (p=0.016) positions, but for the right lateral, left lateral, and supine positions, there was no significant difference. For the PI, there was a statistically significant difference between the mean values taken in the semi fowler, right lateral (p=0.000), supine (p=0.000), and left lateral positions (p=0.043), but there was no significant difference between the right lateral, left lateral, and supine positions (Table 3).

Table 3. Differences in O2 Saturation, Blood Pressure (Systole), and the Perfusion Mean according to Positions (post hoc/Tukey HSD)

Variables	**Position (ı)**	**Supine**	**Left Lateral**	**Right Lateral**	**Semi Fowler**
O_2 saturation	Right Lateral	**.014**	.995		.130
	Supine		**.006**	**.014**	**.000**
	Left Lateral	**.006**		.995	.214
	Semi Fowler	**.000**	.214	.130	
Blood pressure (Systole)	Right Lateral	.996	1.000		**.021**
	Supine		.990	.996	.038
	Left Lateral	.990		1.000	.016
	Semi Fowler	**.038**	**.016**	**.021**	
Perfusion Index	Right Lateral	1.000	.259		**.000**
	Supine		.307	1.000	**.000**
	Left Lateral	.307		.259	**.043**
	Semi Fowler	**.000**	**.043**	**.000**	

4. Discussion

This study was conducted to evaluate the effects of different positions on the physiological parameters and perfusion index in intubated children. Although 88.6% of the children in the study were in the 0-5 age range, more patients were diagnosed with respiratory diseases (Table 1). Therefore, the demographic data of the study are similar to those in the literature [8],[12]. Thijsen et al. (2019) stated in their study that the accuracy of pulse oximetry in predicting arterial oxygenation, as well as moderate and increased perfusion index values, contributed little [12]. As a result, the parameters obtained during the position change may differ according to the type of position [12].

In this study, the mean values of SPO2, systolic blood pressure, and PI were significantly higher in the semi-fawler position (Table 2). Augustina et al. (2021) reported that the right lateral position increased the SPO2 value in children with pneumonia. Tor et al. (2019) did not detect any difference in systolic blood pressure values in the measurements they made in the supine and semi-fawler positions in intensive care patients. Emerson and Banasik (1994) emphasized in their study that different positions cause significant changes in systolic and diastolic blood pressure [11]. Thijsen et al. (2019) found PI < 1 at a rate of 52.8% in their study on intensive care patients. Based on these studies, it can be concluded that there is no consensus in the literature [12].

In the study, the SPO2 value in the supine position and the systolic blood pressure and PI value in the semi-fawler position differed from the other positions (Table 3). In line with these data, it is evaluated that hemodynamic measurements can be made safely with the head of the bed at 45˚, without placing the patients in the supine position of 0˚[13].

Göcze et al. (2013), in their study with patients connected to mechanical ventilators, reported that their central venous pressure changed, arterial blood pressure decreased, and oxygen saturation was significantly reduced in the third-minute measurements of the semi-fowler position compared to different positions in which they placed the patients [14]. Brindle et al. (2013) stated that the hemodynamic parameters return to normal after five to ten minutes in different positions [15]. The difference in research findings may be due to the difference in measurement times. Tapar et al. (2018) stated that different body positions might affect the PI. Based on the literature, it can be concluded that the choice of the various positions is not made within the framework of a standard protocol [16].

5. Conclusion

It is important to evaluate the effectiveness of the positions applied to patients for critical patient follow-up in pediatric intensive care units [9]. Studies in this area are controversial [13], [14], [15]. When positioning patients by nurses, it will be beneficial to choose positions that allow comfortable breathing, do not increase pain, minimize the risk of aspiration, positions the transducer correctly, and consider patient comfort. In addition, during treatment and care practices, for example, It is recommended to plan new studies that will investigate the effects of different positions given to patients in the operating room, during postural drainage, on hemodynamic measurements and create evidence for nursing practices [13].

This study determined that the systolic blood pressure, SPO2, and PI values of the Semi Fowler position, in which patients are placed in two-hour cycles, are significantly higher than the supine, right lateral, and left lateral positions. According to these data, it can be concluded that the Semi Fowler position is more effective in pediatric patients with mechanical ventilator support. When nurses position patients, it is beneficial to pay attention to their respiratory, pain-free, and patient comfort. In addition, to create standard care recommendations in the literature, it is recommended to conduct studies in different patient groups, with repeated and different measurements at different time intervals.

Ethical Statement:

Before starting the research, approval was obtained from the ethics committee of the Health Sciences University Gazi Yaşargil Training and Research Hospital (Date: 03.09.2021, Number: 884). Necessary information was given to the parents of the patients, and their consent was obtained in line with their voluntary participation.

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Authors' Contributions:

All authors contributed as follows:

E.T: Conceptualization, Methodology, Resources, Investigation (%40).

M.T: Conceptualization, Methodology, Formal analysis, Writing - Original draft preparation (%35).

G.B: Conceptualization, Methodology, Formal analysis, Writing - Original draft preparation (%25).

All authors read and approved the final manuscript.

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Research Article

SEROPREVALENCE OF TRANSFUSION TRANSMISSIBLE INFECTIONS IN BLOOD DONORS OF A NEWLY ESTABLISHED TERTIARY CARE TEACHING HOSPITAL NEAR SUNDARBAN REGION OF WEST BENGAL

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Abstract: *The present study was aimed to explore the socio-demographic profile of blood donors and to ascertain the seroprevalence of transfusion-transmissible infections (TTIs) among them. A three year retrospective cross-sectional study was conducted from January 2020 to December 2022. Blood donors' records were obtained from a tertiary care teaching hospital's blood bank and analysed through Epi Info7. A total of 32946 donors were screened; out of them, 22991 (69.78%) were voluntary donors and the remaining 9955 (30.22%) were replacement donors. The majority of the donors were male (76.74%) and 1.22% of them were seropositive for TTIs. Hepatitis B had the highest seroprevalence (0.72%), followed by hepatitis C (0.18%), syphilis (0.13%), and human immunodeficiency virus (0.08%). Malaria was not detected in any donor. We found the highest seropositivity among the age group of 31-40 years (47.12%). It was concluded that, the risk of TTIs can be further minimized through increased community awareness regarding voluntary blood donation, meticulous donor screening, and continuous use of more sensitive testing.*

Keywords*: Blood bank, Blood donors, Seroprevalence, Transfusion-transmissible infections.*

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1. Introduction

Transfusion of blood is an important treatment modality in the modern healthcare system which is essential to survive the patients who have suffered blood loss. But unfortunately, blood is an ideal medium for transmitting infective agents that might exist in donors blood who apparently appear healthy and asymptomatic [1].

An infection that can transmit from one individual to another through parenteral administration of blood or its components is referred as transfusion-transmissible infection (TTI), such as human immunodeficiency virus (HIV), hepatitis B (HBV), hepatitis C (HCV), syphilis, malaria, toxoplasmosis, brucellosis, and other viral infections [2].

It's a matter of great concern that, the infected individual serves as a reservoir for the infectious agents that might spread during its asymptomatic stage; thus, TTI-induced diseases have prolonged impacts on transfusion recipients, their family members, and communities [3,4].

Apart from HIV, the serosurveillance for HBV, HCV or syphilis is not routinely conducted in the Indian adult population. Therefore, the seroprevalence of the blood donors can be utilised to track the trend of these TTIs in the community's healthy appearing adult population [5,6].

As per the guidelines of the National AIDS Control Organization (NACO), each blood sample must be tested for HBV, HCV, HIV1 and 2, syphilis and malaria. Blood donation should be permanently prohibited for the donors with a history of HIV, hepatitis B surface antigen (HBsAg) or hepatitis C virus antibody positivity; however, those with a history of malaria should be accepted after three months of asymptomatic period [7].

The high incidence of infectious pathogens among the asymptomatic blood donors makes transfusion of blood and its components a significant problem in developing nations like India [8]. The HIV prevalence rate in Indian adults was 0.2– 0.3% [9], HBsAg was 1-3%, while HCV infection affected 4-19.2% of blood donors [10].

Even with effective strategies, transmission of TTIs is still occurring due to incapability of routine investigations to identify the infection in the window period, the high cost of advanced screening tests, a lack of trained staff and funds, and laboratory testing errors [11].

Our medical college is a newly established tertiary care referral institute near the Sundarban region of West Bengal that serves patients from both rural and urban areas. In this part of West Bengal, no prior research has been conducted on the blood donors to assess their seroprevalence of TTIs. In this context, the current research has been planned among the blood donors to study the socio-demographic profile and their TTI seroprevalence. This study will also help us to roughly estimate the TTIs prevalence in the general asymptomatic people of the region.

2. Materials and methods

We conducted a retrospective record-based cross-sectional study at the blood bank of Diamond Harbour Govt. Medical College and Hospital, West Bengal. Data were obtained from the blood bank records for a period of three years, from January 2020 to December 2022, for analysis. During this period, a total of 32946 blood units were collected by conducting blood donation camps in different areas of South 24-Parganas and also through in-house replacement donations from relatives and friends of patients of this institution.

All blood units were obtained from non-remunerative donors, who were selected according to national standards and NACO guidelines. During recruitment, they were interviewed and screened to assess their high-risk behaviors for hepatitis B, hepatitis C, HIV and syphilis. A registration form was also filled out, which contained information on the donors' personal, demographic and medical history.

2.1. Study population

All blood donors, whether voluntary or replacement, throughout the research period.

2.2. Donor inclusion criteria

Age limit of 18 to 60 years, body weight 45 kg or more, hemoglobin 12.5g% or higher, no preceding record of HIV, hepatitis B, hepatitis C, or syphilis, and absence of jaundice within last twelve months were strictly adhered.

2.3. Exclusion criteria

We excluded the blood units that were not tested for TTIs due to haemolysis, insufficient volume, or other factors.

2.4. Techniques

- HIV status was detected by using PAREEKSHAK HIV 1/2 ELISA (enzyme-linked immunosorbent assay) to estimate antibodies of HIV1 and HIV2.

- Hepatitis B was detected by using VOXEL HBsAg ELISA (3.0) to detect HBsAg.
- Hepatitis C status was detected by using HEPA-SCAN ELISA to detect antibodies to HCV.
- Syphilis status was detected by Rapid Plasma Reagin kit test (IMMUNOPAK). ELISA procedure was used to confirm positive samples.
- Malaria was tested by a rapid diagnostic kit (MALERISCAN). Peripheral blood smear examination was performed for confirmation.

According to the manufacturer's instructions, all tests were conducted. Each reactive sample was reassessed before being labeled as seropositive and discarded, maintaining the standard biomedical waste disposal procedure. All seroreactive donors were turned away from blood donation and transferred to the proper departments for therapy.

2.5. Data evaluation

Data were collected in an Excel sheet and analyzed with Epi Info7. Numbers and percentages were utilized to denote the statistical variables.

2.6. Ethical statement

The ethical review committee of Diamond Harbour Govt. Medical College and Hospital, West Bengal, India, has approved the study vide letter no. DHGMC/2023/427 dated March 14, 2023.

3. Results

We evaluated total of 32946 donors over the span of 3 years, from January 2020 to December 2022. Out of them, 22991 (69.78%) were voluntary donors, leaving 9955 (30.22%) as replacement donors (Table 1).

Table 1. Total blood donations through voluntary and replacement donors

Year	Total donation	Voluntary n (%)	Replacement n (%)
2020	11782	6078 (51.59)	5704 (48.41)
2021	10388	7794 (75.03)	2594 (24.97)
2022	10776	9119 (84.62)	1657 (15.38)
Total	32946	22991 (69.78)	9955 (30.22)

When the gender-wise distribution of the donors and their seropositivity were studied, it was found that male donors were 76.74% and 1.22% of them were seropositive, whereas female donors were 23.26% and 0.74% of them were seropositive (Table 2).

Table 2. Distribution of blood donors and seroreactivity by gender

Year	Total donation	Male		Female	
		Donors n (%)	Reactive n (%)	Donors n (%)	Reactive n (%)
2020	11782	9595 (81.44)	111 (1.16)	2187 (18.56)	20 (0.91)
2021	10388	7814 (75.22)	103 (1.32)	2574 (24.78)	15 (0.58)
2022	10776	7873 (73.06)	94 (1.19)	2903 (26.94)	22 (0.76)
Total	32946	25282 (76.74)	308 (1.22)	7664 (23.26)	57 (0.74)

Over the years, the prevalence of different TTIs in blood donors has been depicted in Table 3. The overall prevalence of all the TTIs during these 3 years was 1.11%. Regarding specific TTI, we observed that, the majority of the donors (n=237, 0.72%) were seroreactive for HBV infection, followed by 58 (0.18%) donors for HCV, 43 (0.13%) donors for Syphilis and 27 (0.08%) donors for HIV

infection. We did not find any seropositivity for malarial parasites among the donors. The highest prevalence of HBV infection (n=87, 0.74%) and Syphilis (n=17, 0.14%) were seen in 2020, whereas HCV prevalence was highest (n=24, 0.23%) in 2021.

Table 4 displays the age-based distribution of different TTIs within the donors. Most of the HBV, HCV and syphilis-reactive donors belonged to 31-40 years of age, while the majority of HIV-reactive donors were between the ages of 18-30 years.

Table 3. TTI prevalence in blood donors

Year	Total Donors	HIV (%)	HBV (%)	HCV (%)	Syphilis (%)	Malaria (%)	Reactive Donors (%)
2020	11782	12 (0.10)	87 (0.74)	15 (0.13)	17 (0.14)	0	131 (1.11)
2021	10388	5 (0.05)	76 (0.73)	24 (0.23)	13 (0.13)	0	118 (1.14)
2022	10776	10 (0.09)	74 (0.69)	19 (0.18)	13 (0.12)	0	116 (1.08)
Total	32946	27 (0.08)	237 (0.72)	58 (0.18)	43 (0.13)	0	365 (1.11)

Table 4. TTI prevalence in blood donors by age (year) (n =32946).

TTIs	18 – 30	31 - 40	41 - 50	≥ 51	Total n (%)
HIV	14	12	1	0	27 (0.08)
HBV	90	109	28	10	237 (0.72)
HCV	19	30	4	5	58 (0.18)
Syphilis	11	21	8	3	43 (0.13)
Malaria	0	0	0	0	0 (0.0)
Total	134 (36.71%)	172 (47.12%)	41 (11.23%)	18 (4.93%)	365 (1.11)

4. Discussion

Transfusion of blood is an essential part of the present healthcare system to save lives, but unfortunately, it comes with the potential hazards of contracting various TTIs that can exist in the blood obtained from apparently healthy-appearing donors [12]. Strategies should be implemented for the meticulous screening of donors prior to blood donation and the use of sensitive screening tests that can reduce or to some extent can eliminate the probability of acquiring TTIs [13].

Non-remunerated voluntary blood donation (VBD) is the cornerstone for a safe and adequate blood supply. Our investigations revealed that, the majority (69.78%) were voluntary donors, whereas replacement donors constituted 30.22% (Table 1) and this finding is equivalent to other studies [1,11]. The proportion of VBD in the present research was higher than in other Indian studies by Bhawani *et al.*[14] (41.64%), Kaur *et al.*[15] (45%) and Adhikary *et al.*[16] (61.24%), but it was less, compared to Bhaumik *et al.*[17] (91.8%). These regional variations in VBD can be reduced by raising public awareness regarding its necessity [18]. We found a mild increase in replacement donors (48.41%) in 2020 as compared to the proportion of the remaining two years, which might be due to the COVID-19 pandemic and resultant lockdown, leading to a decrease in blood donation camps and voluntary donors.

In this research, male and female donors were respectively 76.74% and 23.26% (Table 2) and this finding was nearly equivalent to that of Karmakar *et al.* [19] but there are other Indian studies [11,20] where the proportion of female donors (2.2-2.6%) was very low, which may be due to social misbelieves regarding blood donation and increased deferral of female donors on medical grounds. In the present study, the seropositivity among male and female donors was respectively 1.22% and 0.74%, which is less as compared to other studies [4,19] and this lower proportion might be the result of meticulous pre-donation screening of the donors.

Among the various TTIs, HBV seroprevalence (0.72%) was the highest in our study, which was similar to other studies [11,21]. There are many Indian research where the HBV prevalence was variable,

ranging from 0.28-8.1% [16,19,20,22] and this may be due to the clustering of HBV infection in different regions and population heterogeneity.

HCV prevalence in our research was 0.18%, which was almost similar to other studies [16,21]. But this proportion was also varying (ranging from 0.06-8.7%) in different research [6,11,19,22], which might be the result of variations in socioeconomic status, cultural practices, different healthcare systems, disparities in the donor populations investigated or the test kit used for screening.

In this research, syphilis prevalence was 0.13%, which is equivalent to Leena *et al*.[21], but some variations were observed in previous reports (ranging from 0.004 - 2%) by several authors [11,16,19] and this might be due to population diverseness, socioeconomic factors and behavioral differences.

HIV prevalence in our research was 0.08%, which is less than previous reports of other authors [19,21] and this lower prevalence rate might be the result of rejection of the high-risk donors through strict pre-donation screening, socio-demographic variables and the false-negative donors who were in the 'window period'. Transmissions of various infectious agents are possible during the window period, which can be lowered by rejecting the high-risk donors through meticulous screening and using more sensitive screening tests such as the nucleic acid amplification test (NAT).

In our investigation, no donor was found positive for malarial parasites, which matches the finding of Adhikary *et al*.[16].

In the present research, the age range of 31-40 years showed the highest seroprevalence (47.12%), followed by 36.71% in 18-30 years of age [Table 4]. Seroprevalence was lowest (4.93%) in the age range of 51-60 years, which was equivalent to other studies [19,24].

The limitation of our study is that TTIs due to emerging infectious agents like the Ebola virus, SARS coronavirus, chikungunya, dengue, leishmaniasis, toxoplasmosis, etc. have not been covered.

5. Conclusion

Blood donation is a noble social work and people need to be motivated to undertake it. However, the participants should be acquainted with transfusion-transmissible diseases through continuous awareness and education so that diseased individuals can detect themselves through periodic screening tests and opt-out of blood donation. Although the pattern of TTIs fluctuates from year to year and varies in the general population, it can be utilized as a monitoring tool that might be beneficial in the formulation and implementation of public health policies. High prevalence necessitates additional sensitive screening tests, including NAT, to reduce the risk of TTI.

Ethical statement

The ethical review committee of Diamond Harbour Govt. Medical College and Hospital, West Bengal, India, had approved the study vide letter no. DHGMC/2023/427 dated March 14, 2023.

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Conflict of interest

None of the authors have any type of conflict of interest regarding this study.

Authors' Contributions:

S.M.: Conceptualization, methodology, data collection, analysis, revisions, and finalization of the manuscript.

S.D.: Data collection, formal analysis, and preparation of the manuscript.

S.S.: Conceptualization, revisions, and finalization of the manuscript.

The final manuscript was read and approved by all authors.

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Research Article

DETERMINATION OF UNIVERSITY STUDENTS' HPV KNOWLEDGE LEVELS AND THE AFFECTING FACTORS: A SAMPLE OF NORTHERN CYPRUS

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Abstract: *Human Papilloma Virus (HPV), infecting millions of men and women every year, is one of the most common STDs causing high mortality and morbidity rates. This study aims to determine university students' Human Papilloma Virus knowledge levels and the affecting factors. The descriptive and cross-sectional study was conducted with a sample of 369 students who were enrolled in the Turkish undergraduate and associate degree programs at a university in Northern Cyprus and met the research criteria. Data were collected through the Personal Information Form and the Human Papilloma Virus Knowledge Measure (HPV-KM). Of all the students 47.7% were aged 18-21 years, 50.1% were women, and only 1.1% had been vaccinated against HPV. The total mean score obtained from the HPV-KM was found to be 19.11±42. Factors affecting the HPV-KM scores were found as age (p<0.001), income level (p<0.001), place of living (p<0.001), family structure (p<0.001), program enrolled (p<0.001), parents' education level (p<0.001), parents' working (p<0.001), smoking (p<0.001), using alcohol (p<0.001), being sexually active(p<0.001), and knowing about sexually transmitted diseases (p<0.001). Students have an above-average HPV knowledge level, and several socio-demographic factors affect the HPV knowledge level. HPV vaccination rates are quite low.*

Keywords: *Human Papilloma Virus, sexually transmitted diseases, university students, knowledge level,*

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1. Introduction

Human Papilloma Virus (HPV) is a double-stranded and nonenveloped deoxyribonucleic acid (DNA) virus that infects soft tissues such as skin or mucosal cells. At least 13 of 200 genotypes of HPV, one of the most common sexually transmitted diseases (STD), cause cervical cancer. Particularly two types of the virus (HPV type 16 and 18) account for 70% of cervical cancers [1].

There are 2.869.0 million women worldwide who are over 15 and at risk of cervical cancer. In the year 2020, 604.000 new cases were diagnosed and 342.000 women lost their lives due to cervical cancer. Hence, cervical cancers are ranked fourth among the most common female cancer types worldwide [2]. Studies conducted in recent years have revealed the relationship of the virus with other urogenital (anus, vulva, vagina, penis) cancers as well as head and neck cancers [3]. According to global statistics, HPV-related oral cavity cancer, laryngeal cancer, and oropharyngeal cancer burden is higher in men than women. For this reason, the life-threatening nature of HPV for both men and women has been understood better [4].

Owing to the reasons explained above, HPV was accepted as a serious public health concern in the WHO assembly in 2020, and the incidence rate of women with cervical cancer was aimed to be

decreased below four per 100 000 women [2,5]. The prerequisites for achieving the determined targets by the year 2030 were reported as vaccinating 90% of girls aged 15 years, having HPV screenings for 70% of women by the age of 35, and treating 90% of patients with cervical cancer [5]. However, global statistics indicate that we are far behind the targets determined for the elimination of cervical cancer. For instance, the rates of vaccination against HPV are only 15% worldwide [6]. As to HPV screening tests, although a decrease was reported in new cases and mortality rates within the past 50 years, the number of women who are late for screening is also increasing every day [7]. Failure to reach the expected targets inevitably causes a higher number of new cases and mortality rates [8]. Social awareness, particularly awareness of young people aged 15-25 years, is highly important because the prevalence of the disease is very high in this age group [9-11]. Besides, this age group is more inclined to follow contemporary news and changes and is more involved in formal education systems as well as informal learning processes. With these characteristics, young individuals aged 15-24 years have a key role in reducing HPV. In this regard, the literature reports different HPV awareness and knowledge levels. For instance, only a small number of university students enrolled in the field of health sciences were reported to have a good HPV knowledge level [12, 13]. Studies conducted with university students from different disciplines also reported low HPV knowledge levels in the majority of students [14-17]. Even the studies conducted with students who accessed HPV vaccines also reported low HPV knowledge levels.

Northern Cyprus is a small island country with low income, obtains the majority of its income from tourism and education, and thus hosts 108.204 young people every year [18]. The country provides women aged 30-65 years with a free pap-smear test for cervical cancer screening. Besides, those who want can pay for HPV-DNA tests in private health institutions. Efforts were made to include the HPV vaccine in the National Vaccination Schedule within the scope of health services, and then the Ministry of Health announced that vaccine services were started for girls aged 12 years [19]. However, no statistical evidence was found regarding the access of young individuals aged 12 years to the HPV vaccine in Northern Cyprus. In addition, no studies in the country seem to have investigated HPV awareness and knowledge levels. On the other hand, cervical cancer is ranked ninth among the top 10 female cancer types in the country, which indicates the inadequate fight against HPV [20]. In this regard, the purpose of this study is to determine HPV knowledge levels and affecting factors among university students in Northern Cyprus.

Research Questions

1. What is university students' Human Papilloma Virus knowledge level?
2. What factors affect university students' Human Papilloma Virus knowledge level?

2. Material and Method

2.1. Research design, target population, and the sample

This descriptive and cross-sectional study was conducted at a university located in Northern Cyprus between February and June 2021. The target population of the study was 8823 students who were enrolled in the Turkish programs during the spring semester of the 2020-2021 academic year. A stratified random sampling method was utilized to access students to represent the target population (Table 1). Hence, with a 95% confidence interval and 5% sampling error, the number of participants to be accessed was determined as 369 out of 8823 individuals. The inclusion criteria were being enrolled in Turkish undergraduate or associate degree programs and agreeing to participate in the study.

Table 1. Distribution of the sample by strata

Department	N	Ni/N	n
Faculty of Business and Economics	311	0.04	13
Faculty of Engineering	785	0-09	33
School of Computing and Technology	501	0.06	21
Faculty of Arts and Sciences	1181	0.13	49
School of Tourism	499	0.06	21
Faculty of Law	961	0.11	40
Faculty of Architecture	605	0.07	25
Faculty of Communication	389	0.04	16
Faculty of Medicine	167	0.02	7
Faculty of Education	1290	0.15	54
School of Business and Finance	159	0.02	7
Faculty of Health Sciences	1107	0.13	46
School of Justice	43	0.00	2
Faculty of Pharmacy	239	0.03	10
School of Health Services	546	0.06	23
Faculty of Dentistry	40	0.00	3
Total	8823	1.0	369

Ni /N: The ratio of the total number of students in each faculty to the study population

2.2. Data collection process and tools

Data were collected online through the ‘‘Personal Information Form’’ and the ‘‘Human Papilloma Virus Knowledge Measure (HPV-KM)’’ during the Covid-19 pandemic period by sending the data collection tool to students’ emails. The forms prepared in Google Forms continued to be sent to students’ emails until the calculated sample size was reached. Online questionnaires were set in a way to be filled in only once, and answering all the questions was compulsory. In this way, filling in more than one form was not possible. Besides, potential data loss was prevented as each question had to be responded.

2.2.1 The Personal Information Form:

This form was developed by the researcher in line with the literature (12-17) to determine some socio-demographic characteristics that can affect participants’ HPV knowledge level. The form included 17 questions that aimed to collect data about gender, age, income level, place of living, family type, parents’ education, parents’ working or not, use of cigarettes and alcohol, being sexually active, etc.

2.2.2 Human Papilloma Virus Knowledge Measure (HPV-KM)

The scale developed by Waller et al. in 2013 aims to measure individuals’ HPV knowledge level. Turkish reliability and validity of the scale were performed by Demir and Özdemir in 2019. The scale has 29 items and 4 sub-scales one of which is independent. Each item of the HPV-KM is responded as "Yes", "No" or "I don’t know". While correct answers are scored 1, wrong answers and "I don’t know" are scored 0. Scores to be obtained from the scale range between 0 and 33, with higher scores indicating higher levels of knowledge about HPV. Cronbach’s alpha value of the Turkish version of the scale was 0.96 [21]. This study found Cronbach’s alpha value as 0.71.

2.3. Statistical analyses

Data obtained from the study were analyzed using Statistical Package for Social Sciences (SPSS) 25.0 program. The distribution of the participants' descriptive characteristics was demonstrated using frequency analyses. The participants' HPV Knowledge Measure scores were also demonstrated through descriptive statistics such as means, standard deviations, and minimum and maximum values. The Kolmogorov-Smirnov test was utilized to find out the normality of the data distribution. Non-parametric

hypothesis tests were used as the data were found to be distributed non-normally. Hence, the Mann-Whitney U test was utilized when the independent variable was composed of two groups and the Kruskal-Wallis H test was utilized when it was composed of three and more groups. Further analysis included Bonferroni corrected Mann-Whitney U test.

Ethical statement: Before the study was conducted, ethics approval was obtained from the Eastern Mediterranean University Ethics Committee (ETK00–2020-0239, dated November 17, 2020), and a research permit was obtained from the University Rectorate. Participants were asked to submit their consent via an online consent form prepared in accordance with the Declaration of Helsinki.

3. Results

This study was conducted with 369 students. Of all the participants 58.3% (n=215) were sexually active, 87.5% (n=353) had information about STDs, 56.1% (n=207) smoked, and 71.5 % (n=264) used alcohol. Only 1.1% (n=4) of the participating students had been vaccinated against HPV. Other descriptive characteristics of the participants are demonstrated in Table 2.

Table 2. Distribution of the descriptive characteristics (n=369)

	Number (n)	**Percentage (%)**
Gender		
Female	185	50.1
Male	184	49.9
Age Group		
18-21 years	176	47.7
22-25 years	159	43.1
26 years and over	34	9.2
Income		
Income less than expenses	66	17.9
Income equal to expenses	181	49.0
Income more than expenses	122	33.1
Family Structure		
Nuclear Family	228	61.8
Extended Family	93	25.2
Fragmented Family	48	13.0
Place of Living		
With family	214	58.0
Dormitory	44	11.9
House-with friends	54	14.6
House-alone	57	15.5
Mother's education level		
Did not finish a school	41	11.1
Primary school	46	12.5
Secondary school	29	7.8
High school	124	33.6
University	129	35.0
Father's education level		
Did not finish a school	34	9.2
Primary school	35	9.5
Secondary school	29	7.9
High school	95	25.7
University	176	47.7

Table 2 Continued.

	Number (n)	Percentage (%)
Mother's working or not		
Working	197	53.4
Not working	172	46.6
Father's working or not		
Working	303	82.1
Not working	66	17.9
Marital Status		
Single	339	91.9
Married	30	8.1
Having children		
No	348	94.3
Yes	21	5.7
Program enrolled		
Health Sciences	89	24.1
Other Sciences	280	75.9
Class year		
First	116	31.4
Second	100	27.1
Third	77	20.9
Fourth	76	20.6

Students' total HPV-KM mean score was 19.41±4.76 (min=9 max=32), and the distribution of the scores obtained from the sub-scales is demonstrated in Table 3.

Table 3. Students' HPV-KM mean scores (N=369)

	n	$\bar{x}$	s	Item($\bar{x}$)	Min	Max
General HPV Knowledge Sub-scale	369	9.82	2.86	0.61	3	15
HPV Testing Knowledge Sub-scale	369	3.80	1.15	0.63	0	6
HPV Vaccination Knowledge Sub-scale	369	3.59	1.57	0.51	0	7
Knowledge about the current HPV Vaccination Program Sub-scale	369	2.21	0.79	0.55	0	4
Total HPV-KM Score	369	19.41	4.76	0.59	9	32

HPV-KM: Human Papilloma Virus Knowledge Measure

A comparison of students' HPV-KM scores according to some of their descriptive characteristics is given in Table 4. Comparisons showed that gender, marital status, and having children had no effects on the HPV-KM scores ($p>0.05$). On the other hand, HPV-KM scores were found to be lower in those who were aged 26 years and over, who had income less than expenses, who lived with their family or in a dormitory, and who received education in departments other than health sciences ($p<0.05$). In addition, the HPV knowledge level of first-year students was found to be lower compared to students in higher class levels ($p<0.05$).

Table 4. Comparison of HPV-KM scores according to descriptive characteristics (N=369)

Descriptive Characteristics		General HPV Knowledge Sub-scale	HPV Testing Knowledge Sub-scale	General HPV Vaccination Knowledge Sub-scale	Knowledge about HPV Vaccination Program Sub-scale	Scale Total Score
Gender	Female	9.96±2.75	3.69±1.15	3.68±1.60	2.20±0.79	19.52±4.53
	Male	9.69±2.97	3.90±1.14	3.49±1.54	2.21±0.79	19.30±4.49
	P	0.219	0.142	0.247	0.914	0.241
Age	18-21 years	9.94±2.78	3.82±1.17	3.46±1.56	2.17±0.77	19.39±4.71
	22-25 years	10.09±2.91	3.75±1.19	3.91±1.58	2.31±0.80	20.06±4.82
	26 and over	7.97±2.42	3.88±0.88	2.74±1.14	1.91±0.71	16.50±3.63
	P / Difference	**0.000 1-3 2-3**	0.509	**0.000 1-3 2-3**	**0.005 1-3 2-3**	**0.000 1-3 2-3**
Income level	Income less than expenses	8.52±2.30	3.83±0.92	2.97±1.39	2.03±0.61	17.35±3.64
	Income equal to expenses	9.76±2.83	3.81±1.04	3.38±1.40	2.15±0.78	19.09±4.51
	Income more than expenses	10.63±2.92	3.75±1.39	4.23±1.69	2.39±0.86	21.00±5.15
	P / Difference	**0.000 1-3**	0.903	**0.000 1-3**	**0.015 1-3**	**0.000 1-3**
Place of living	With family	9.51±2.51	3.65±1.09	3.36±1.53	2.13±0.73	18.65±4.05
	In dormitory	8.55±2.95	3.75±0.89	3.30±1.49	1.95±0.48	17.55±4.46
	At home with friends	11.67±2.97	4.22±1.31	4.43±1.64	2.74±0.94	23.06±5.42
	At home alone	10.23±3.12	3.96±1.28	3.88±1.39	2.18±0.85	20.25±5.01
	P / Difference	**0.000 1-3 1-4 2-3 2-4**	**0.004 1-3 1-4 2-3 2-4**	**0.000 1-3 1-4 2-3 2-4**	**0.000 2-3 2-4**	**0.000 1-3 1-4 2-3 2-4**
Marital Status	Single	9.87 ±2.82	3.81±1.15	3.58±1.56	2.21±0.78	19.47±4.67
	Married	9.33 ±3.29	3.67±1.18	3.60±1.65	2.20±0.89	18.80±5.70
	P / Difference	0.309	0.608	0.917	0.627	0.251
Having children	No	9.83±2.83	3.80±1.13	3.56±1.57	2.20±0.78	19.39±4.68
	Yes	9.71±3.47	3.67±1.43	3.95±1.56	2.38±0.97	19.71±6.03
	P / Difference	0.750	0.772	0.318	0.565	0.707
Program enrolled	Health Sciences	11.25±2.80	3.90±1.41	4.03 ±1.78	2.40±0.79	21.57±5.22
	Other sciences	9.50±2.78	3.77±1.08	3.49±1.50	2.16±0.78	18.92±4.52
	P / Difference	**0.000**	0.237	**0.020**	**0.033**	**0.000**
Class year	First-year	9.72±2.51	3.76±0.99	3.19±1.46	2.13±0.64	18.80±3.93
	Second year	10.26±3.41	3.91±1.36	3.87±1.65	2.39±0.94	20.43±5.72
	Third year	9.53±3.84	3.70±1.11	3.74±1.63	2.12±0.83	19.09±4.92
	Fourth-year	9.70±2.57	3.80±1.12	3.66±1.47	2.17±0.70	19.33±4.20
	P / Difference	0.608	0.339	**0.008* 1-2 1-3 1-4**	0.101	0.396

*HPV-KM: Human Papilloma Virus Knowledge Measure, the Mann-Whitney U test was utilized when the independent variable was composed of two groups and the Kruskal-Wallis H test was utilized when it was composed of three and more groups. Further analysis included Bonferroni corrected Mann-Whitney U test, *p<0,05,*

Table 5 demonstrates students' HPV-KM scores according to some family characteristics and habits. HPV-KM scores were found to be higher in those who grew up with a single parent, whose parents' education level was high, and whose parents had wage-earning employment ($p<0.05$). On the

other hand, HPV-KM scores were lower in those who were not sexually active, and who did not use alcohol and cigarette ($p<0.05$).

Table 5. Comparison of students' HPV-KM scores according to some family characteristics and habits (N=369)

Descriptive Characteristics		General HPV Knowledge	HPV Testing Knowledge	General HPV Vaccination Knowledge	Knowledge about the current HPV Vaccination Program	Scale Total Score
Family type	Nuclear	9.59±2.56	3.65±1.11	3.55±1.55	2.09±0.69	18.89±4.13
	Extended	9.68±3.12	3.83±1.20	3.40±1.55	2.30±0.86	19.20±5.17
	Single parent	11.23±3.33	4.42±1.05	4.10±1.61	2.56±0.94	22.31±5.73
	P / Difference	**0.005 1-3 2-3**	**0.000 1-3 2-3**	**0.037 2-3**	**0.002 1-3**	**0.001 1-3 2-3**
Mother's education level	Did not finish a school	7.49±2.04	3.63±0.99	3.00±1.40	2.00±0.39	16.12±2.71
	Primary school	9.07±2.52	4.02±0.80	3.02±1.31	1.96±0.76	18.07±4.02
	Secondary school	8.86±2.43	3.79±0.94	3.03±1.27	2.03±0.57	17.72±3.18
	High school	9.93±2.61	3.76±1.13	3.40±1.56	2.27±0.7+	19.35±4.54
	University	10.95±2.95	3.81±1.35	4.27±1.54	2.34±0.92	21.37±5.14
		0.000* 1-2. 1-3. 1-4. 1-5. 2-4. 2-5. 3-4. 3-5	0.625	**0.000 1-5 2-5 3-5**	**0.018 2-5**	**0.000 1-2 1-3 1-4 1-5 2-5 3-5**
	P					
Father's education level	Did not finish a school	7.65±2.19	3.47±1.05	2.85±1.46	2.06±0.34	16.03±2.81
	Primary school	8.80±2.00	3.80±0.99	3.29±1.27	2.06±0.84	17.94±3.33
	Secondary school	8.97±2.50	4.00±0.80	2.90±1.37	2.17±0.47	18.03±3.90
	High school	9.54±2.70	3.71±1.04	3.31±1.43	2.16±0.75	18.71±4.04
	University	10.74±2.91	3.88±1.29	4.05±1.61	2.30±0.89	20.97±5.21
		0.000* 1-2. 1-3 1-4. 1-5. 2-5. 3-5	0.390	**0.000* 1-5 3-5**	0.497	**0.000* 1-2. 1-3 1-4. 1-5. 2-5.3-5**
	P					
Mother's working	Working	10.36±3.01	3.80±1.26	3.92±1.57	2.30±0.81	20.38±5.04
	Not working	9.22±2.56	3.80±1.01	3.20±1.48	2.09±0.74	18.31±4.16
	P	**0.000***	0.702	**0.000***	**0.006**	**0.000***
Father's working	Working	10.12±2.85	3.81±1.20	3.72±1.57	2.25±0.82	19.90±4.82
	Not working	8.48±2.52	3.76±0.90	2.95±1.41	1.98±0.54	17.18±3.75
	P	**0.000***	0.772	**0.000***	**0.022**	**0.000***
Being sexually active	Yes	10.26±2.86	3.83±1.25	3.95±1.60	2.29±0.83	20.33±5.00
	No	9.21±2.76	3.75±0.99	3.08±1.38	2.08±0.70	18.13±4.09
	P	**0.001**	0.762	**0.000***	**0.025**	**0.000***
Using alcohol	Yes	10.16±2.88	3.77±1.25	3.83±1.61	2.30±0.83	20.06±4.95
	No	8.97±2.65	3.87±0.83	2.97±1.27	1.98±0.62	17.79±3.80
	P	**0.001**	0.571	**0.000***	**0.001**	**0.000***
Smoking	Yes	10.20±3.11	3.79±1.26	3.75±1.57	2.33±0.85	20.07±5.21
	No	9.34±2.43	3.80±0.99	3.38±1.55	2.05±0.68	18.57±3.98
	P	0.010	0.799	**0.024**	**0.003**	**0.019**

*HPV-KM: Human Papilloma Virus Knowledge Measure, the Mann-Whitney U test was utilized when the independent variable was composed of two groups and the Kruskal-Wallis H test was utilized when it was composed of three and more groups. Further analysis included Bonferroni corrected Mann-Whitney U test, *p<0,05,*

4. Discussion

HPV, infecting millions of men and women every year, is one of the most common STDs causing high mortality and morbidity rates [1]. Therefore, there is a need for comprehensive approaches to prevent HPV and bring it under control. These approaches to providing lifelong interventions in a multidisciplinary manner should include scientific studies, social awareness activities, public education, vaccinations, and treatment and palliative care [2].

There is a strong relationship between the development level and health indicators of countries. For instance, the risk of cervical cancer is much higher for women in underdeveloped countries [8]. Hence, several studies reported that university students in these countries had a low or medium level of knowledge about general HPV, HPV testing, and HPV vaccines [17, 22-24]. For this reason, high HPV awareness and HPV vaccination rates of students in developed countries are somewhat expected [25, 26]. On the other hand, despite high economic development levels, some countries have low HPV awareness. For instance, two studies conducted in Saudi Arabia reported a serious lack of knowledge among university students about cervical cancer, general HPV, and HPV vaccines [14, 15]. Having been vaccinated against HPV is naturally considered to be associated with high HPV awareness and knowledge. On the other hand, two studies conducted in Malaysia included a group of students who all had been vaccinated against HPV and only a small number of students who were vaccinated respectively; both studies determined students' HPV knowledge level as medium [16, 27]. Two separate studies conducted in Bangladesh and Indonesia respectively found that university students' HPV awareness was high, but their level of knowledge about details such as HPV vaccines was low [28, 29]. Owing to the professional education they receive, students enrolled in the field of health sciences can be expected to know better about general HPV as well as the relationship between HPV vaccines and HPV and cancer. However, the majority of the studies on the issue reported low and medium levels of HPV awareness and knowledge among university students enrolled in the field of health sciences [24, 30-32]. Fewer studies reported high levels of HPV awareness of students [12, 33]. This study conducted in Northern Cyprus, like the majority of the studies listed above, includes students from families with medium income levels. Besides, participants also include students from the field of health sciences. Despite this, similar to the studies reported above, students' knowledge level about general HPV, HPV testing, and HPV vaccines was found to be medium.

The global HPV vaccination rate is expected to be 70% by the WHO [5]. As a novel finding for Northern Cyprus, this study found that the HPV vaccination rate was quite low, even close to none (%1,08). Turkey, a neighboring country to Northern Cyprus, does not have an HPV vaccination program, and just like the findings in this study, vaccination rates are reported to be very low (between 1,4% and 1,7%) [23, 24, 34]. As for the other two neighboring countries, vaccination rates in 2012 were reported as 4,1 and 5,2 per 100.000 women in the Republic of Cyprus and Greece, respectively [35]. The findings of this study are similar to those in the Turkish samples and indicate the need for active HPV vaccination programs.

Just like the biological and physiological characteristics of men and women, the roles and responsibilities imposed on them by society and culture also affect their health, health beliefs, and behaviors [36]. Studies that investigated the effect of gender on HPV knowledge report conflicting results. The literature includes studies reporting female students' higher HPV knowledge than males [22, 23, 28, 30, 37]. as well as those reporting high knowledge levels of men [31]. On the other hand, just like the findings of this study, some other studies reported no effects of gender on HPV knowledge [11, 29, 38]. No differences between genders in this study indicate that in recent years, HPV has been acknowledged as a severe risk factor for men too, and thus the difference between genders regarding HPV awareness has gotten smaller [26].

The age range in which HPV prevalence is the highest is reported to be 15-25 years [9-11]. Therefore, the risk perceptions of this age group that is considered at risk should be assessed well [30]. The study conducted in Saudi Arabia reported higher HPV knowledge levels among university students aged 18-25 years compared to those aged over 25 years. Wanderley (2021) also reported that although students aged below 25 years were more willing to be vaccinated against HPV, no relationships were detected between age and HPV knowledge [38]. On the contrary, Çınar et al. (2018) reported that students' HPV awareness and knowledge levels increased with an increase in age [23]. However, the literature also includes some studies that demonstrated no effects of age on HPV knowledge [29, 39]. This study found that the HPV knowledge levels of students aged 26 years and over were lower in comparison to the students aged 25 years and below. This finding is considered to be associated with the increasing number of recent studies on young individuals aged 15-25 years, who are accepted to be at risk in terms of HPV.

Although HPV screening tests are free in many countries, the rates of applying for testing is lower in poor women compared to women with better economic condition [40]. Besides, due to high costs, the interest in the HPV vaccine is higher among groups with high income [6, 41]. In a similar vein, although cervical cancer is one of the most frequently encountered female cancers worldwide, life expectancy after diagnosis is shorter and the mortality rate is much higher in less developed countries [42]. In light of this information, income level has the potential to affect HPV screening, vaccination, and treatment rates as well as HPV knowledge level. A review of the literature based on this finding revealed two studies that reported higher HPV knowledge levels in students with high income [38, 43]. On the other hand, some other studies reported no effects of income level on students' HPV knowledge level [15, 39]. However, when it is considered that income level affects HPV screening programs as well as vaccination and mortality rates, it is believed that the positive effect of income level on HPV knowledge level in this study is not coincident.

Individuals who have developed healthy life behaviors are also known to have high HPV knowledge levels [24]. When the literature was reviewed in terms of this aspect, two studies were found to report high HPV knowledge levels of sexually active students, which is similar to the findings in this study [32, 38]. Smoking is another habit that poses a risk in terms of HPV. However, unlike the findings of the present study, Tunaman et al., (2022) indicated that smoking had no effects on students' HPV knowledge level. Although the literature includes no examples, this study found that HPV knowledge levels were higher in those who used alcohol compared to those who did not [44]. These findings indicate that students who had a secular lifestyle had higher HPV knowledge levels.

Place of living potentially affects an individual's health behaviors and knowledge. However, the literature includes conflicting results on the effects of place of living on HPV knowledge levels. For instance, while Tunaman et al.(2022) reported that students' place of living did not affect their HPV knowledge, Özdemir et al. (2021), similar to the findings in this study, reported higher HPV knowledge levels in individuals who lived at home alone or with their friends [43, 44]. Sexuality is rarely mentioned in the family in traditional societies and traditional families usually prefer dormitories for their children receiving education in other cities, which are considered to be factors associated with lower HPV knowledge levels of students in dormitories. This finding also indicates that HPV trainings to be provided to parents and students in dormitories can be successful in terms of accessing target groups.

Owing to the curriculum they implement, programs providing education in health sciences are expected to provide their students with detailed information about HPV. Hence, students from these departments naturally have higher knowledge levels compared to students from other departments [14, 17, 27, 29]. Although the HPV knowledge level of students from the health sciences is not at the desired level, it is higher in comparison to other students. This finding is in line with the literature.

For many students, the first years of education is a process in which they move away from their families, begin to have increased freedom, and live their first experiences. In this regard, first-year students are critical in terms of first contact with STDs. Besides, students from lower class levels are reported to have less HPV knowledge levels, and their knowledge levels increase with the increase in the class year [12, 15, 30]. HPV vaccination knowledge levels of first-year students were found to be lower compared to students from higher class levels in this study. In this respect, providing HPV education in the first year and repeating the education in the following years are considered to be more effective.

Parents are the first educators of children regarding sexuality issues and play an important role in the development of knowledge, attitudes, and value judgments about sexuality. Therefore, family structure and parent characteristics are predicted to affect adolescents' knowledge levels and awareness about STDs [45]. Unlike this widely accepted view, some studies in the literature reported no effects of family structure on HPV knowledge [44]. This study detected higher HPV knowledge levels in students who grew up with a single parent compared to those who grew up in other family types. Özdemir et al. (2021) also reported that HPV knowledge level was higher in students who had nuclear families compared to students who grew up in an extended family [43]. Higher HPV knowledge levels of students who grew up with single parents can be associated with the less traditional nature of these families, indicating that they discuss sexual issues more or they are more independent in terms of obtaining information.

Not only family structure but also parents' education level has an important role in growing up healthy individuals in the changing and developing world. A review of the literature indicates that parent education level, particularly that of mothers, affects HPV knowledge level [39, 41]. There are some other studies indicating the opposite as well [23, 44]. The findings of this study show that students with high parent education levels also have higher HPV knowledge levels, indicating that HPV education to be provided to parents can help to protect both their own health and the health of future generations.

5. Conclusion

This study detected an above-average level of HPV knowledge in students and indicated several factors affecting the HPV knowledge level. The HPV vaccination rate was found to be quite low, almost close to none. Factors that had positive effects on students' HPV knowledge levels included being aged below 25 years, having income more than expenses, growing up in a single-parent family, having parents who graduated from university, having working parents, receiving education in the field of health sciences, being enrolled in higher class levels, living at home alone or with friends, using cigarette and alcohol, being sexually active, and knowing about STDs. In light of the study findings, it can be recommended to organize HPV trainings at universities for all groups at risk, particularly first-year students. Besides, there is a need for conducting programs and awareness studies to increase HPV vaccination rates. Researchers interested in this issue are recommended to investigate the reasons for low HPV vaccination rates as well as the effects of structured training on university students' HPV knowledge levels and vaccination rates.

Ethical statement

Before the study was conducted, ethics approval was obtained from the Eastern Mediterranean University Ethics Committee (ETK00–2020-0239, dated November 17, 2020), and a research permit was obtained from the University Rectorate. Participants were asked to submit their consent via an online consent form prepared in accordance with the Declaration of Helsinki.

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Conflicts of interest

The authors declare no conflicts of interest.

Authors' contributions

D.G.P: Conceptualization, Methodology, Acquisition of data for the study, Formal analysis, Writing - Original draft preparation

R.M: Conceptualization, Methodology, Formal analysis, Writing - Original draft preparation

All authors read and approved the final manuscript.

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Research Article

COMPARISON OF FACE-TO-FACE AND DISTANCE EDUCATION METHODS IN ACQUIRING LEARNING SKILLS: EVALUATION IN THE PERIOD OF PANDEMIC†

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Abstract: *It was aimed to investigate the effectiveness of two different techniques, distance, and face-to-face education, in the acquisition of learning skills related to the course of an applied undergraduate program course in the ongoing pandemic conditions. This one-group, semi-experimental study was completed with 68 students. "Participant Information Form", "Instruction Form for Preparing Practice Videos" and "Guide to Practice Learning Skills" were used in data collection. The study was carried out in three stages. In the first stage, the course was taught through distance education with theoretical information and educational videos. In the second stage, students were asked to apply first aid, record it on video and send the file via the e-lesson system. In the third stage, the applications were explained face to face by the lecturer in the laboratory environment, and the students were instructed to do these applications. Data were analyzed using the SPSS program. The mean age of the participants was 20.64±0.91 years, while 69.1% (n=47) were female, and 31.9% (n=21) were male. Among the participants, 26.5% (n=18) had previously received training about first aid, whereas 55.5% (n=10) of those who had stated that they received this training in high school. It was determined that the grades that the participants received after the face-to-face applied education process were significantly higher than the grades they received after the distance education process (p<0.001). In the applied courses, it will be useful to use blended education models as much as possible under pandemic conditions.*

Keywords: *Blended learning, distance education, learning skill, nursing students, pandemic*

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1. Introduction

The COVID-19 pandemic, which started in 2019 in China and rapidly spread to the entire world, had continued to be effective so far. One of the fields that have been affected by this issue involves education-instruction activities. As greater numbers of students at schools within an academic year would make it easier for the virus to spread, as in other counties in the world, education institutions in Turkey have also transitioned to distance education since the first months of 2020. [1,2]

Distance education is an instruction method that is based on carrying out classes where educators and students are present in different places and at different times and using information technologies actively to facilitate learning. [3] Distance education has had examples in different periods and different forms around the globe. It is known that education activities took place in the form of sending letters back and forth in the 1700s, through visual-auditory devices (radio and television) in the 1920s, via

† This study has been included as an oral presentation in the 'International Congress on Open Learning and Distance Education 2021 (ICOLDE 2021)' that was organized between 9 and 10 October 2021 and was awarded second place.

teleconferencing in 1980, and through internet- and web-based tools after 1990. While an instruction-focused understanding used to be dominant in distance education, since the 1990s, a learning-focused approach has become prominent. In Turkey, distance education processes have continued in the form of sending letters between 1950 and 1970, with visual-auditory tools between 1976-1995 and through the internet- and web-based tools since 1996. As in the rest of the world, a learning-focused distance education approach has been adopted in Turkey after 1996. [4] Distance education methods in nursing education in Turkey were used for the first time in the training of nurses with high school degrees in associate degree programs between 1991 and 1999. [5] On the other hand, by 2005, it was decided by the European Parliament and Council (2005) that at least half of the education process in nursing should be allocated to the application. [6] In parallel with this, the Council of Higher Education in Turkey also decided in 2008 that the theoretical and clinical parts of nursing education cannot be thought of separately with numerical data (at least 4 years of education, 4600 hours of theoretical and clinical education, at least half consisting of clinical education) and published this decision in the Official Gazette (2008). [7] After this date, nursing education started to be provided through the face-to-face method. However, in nurse training, distance education in the pandemic process has become prevalent in Turkey like in other countries in terms of access to and the sharing of information. [8] Nevertheless, the interruption of formal education brought about problems such as the fact that most students are not used to the method of distance education, infrastructure problems, and adaptation problems. In addition to concerns about physical health associated with the COVID-19 pandemic, the sudden change in education processes affected students mentally and socially in a negative sense. [9,11] Although it is being attempted to develop current strategies that would increase the quality of education, as it takes time to put these into practice, problems continue to be experienced. Thus, distance education has become a factor that is effective in the success status of students. [12] A previous study reported that not every student may succeed in online classes in the distance education process, and the failure rates in distance education classes were 10-20 times higher in comparison to face-to-face classes. [13] A study that was carried out with nursing students revealed that the students passed their classes with average grades, and thus, they were not satisfied with distance education. [14]

Nursing students can gain professional qualifications in the case that they actively participate alongside educators at the clinic and the laboratory. [15] For this reason, nursing education consists mostly of applied classes. [16] The First Aid and Emergency Care Nursing Course that is included in the nursing curriculum is also mostly carried out in the laboratory environment. The purpose of this course is to provide students with the skills of implementing first aid practices that are carried out at the scene or in emergency services in life-threatening cases. While these interventions eliminate the risk of the person's death when they are correctly, effectively, and quickly implemented, they are also highly important in the prevention of morbidities and secondary injuries and in speeding up the recovery process. [17-20] Therefore, conducting first aid-related practices in an environment that allows active participation is highly important for providing students with learning skills.

Because holding an applied class face-to-face during the pandemic period would threaten health, most such classes have been held through distance education. [21] Nonetheless, as the pandemic period is going on in the entire world, and the number of cases per day in Turkey is still high, [22] there are still uncertainties about face-to-face education in the academic years to follow. Even though a transition is made back to face-to-face education, the possibility that not all students will be allowed to be present in laboratories together will affect the time they will spend in laboratories. As a reduction in this time will also influence their effective learning at the times they will be involved, it is crucial to make a good plan accordingly.

The fact that studies have been carried out on education processes since the onset of the pandemic will undeniably be helpful in relevant preparations. Nevertheless, some studies have investigated the

opinions of students and educators about distance education in this period. [23-27] No study that examined the effects of mixed/blended education involving both face-to-face and online education on nursing students' academic success statuses in the Covid-19 pandemic period was encountered. Therefore, this study, it was aimed to analyze the effectiveness of two different techniques as distance education and face-to-face education in providing students taking the First Aid and Emergency Care Course, which is an applied course, with learning skills. It was aimed for this study to support educational institutions, educators, and students in their preparations regarding education and instruction.

2. Materials and Method

2.1. Design

This is a single-group quasi-experimental study. This study was performed according to the TREND reporting guidelines for non-randomized/quasi-experimental studies (Supplementary File-1).

2.2. Population and sample

This study was conducted with students who were taking the First Aid and Emergency Care Nursing course at a state university. Therefore, all students registered for the course constituted the population of the study (N=71). Based on the literature, with α=0.05, an effect size of 0.5, in a 95% confidence interval, and with a 95% power, the minimum required sample size was calculated as 54 participants. [28] The study was completed with a total of 68 students (95.7%) who participated in the distance education and face-to-face education sessions, were taking the course for the first time, did not have any obstacles to performing the practices, and voluntarily agreed to participate in the study.

2.3. Data collection instruments

The data were collected using a Participant Information Form, an Instruction Form for Preparing Application Videos, and a Guideline for Applying Learning Skills.

Participant Information Form: This form that was prepared to collect the data of the participants included six questions on their age, whether they previously received education about first aid, the time and place of this education if they did, whether or not they were working at a job, and their duties at the job if they were.

Instruction Form for Preparing Application Videos: The form included instructions for the participants for their preparation of the application video they would send to the instructor after the completion of the theoretical classes. The instructions clearly described what was expected of them and the scoring system to be used. The practices that were expected of the participants were determined as the application of basic life support, the coma position, applying the Heimlich maneuver, first aid practices in traumas (head-spine, chest, and abdominal injuries), first aid practices in bleeding cases, the shock position, patient transport techniques and identification of fractures. The success levels of the participants were determined over 30 points based on the scores they would obtain from two scoring stages.

The ***first stage*** of scoring, it was aimed to measure the critical thinking and decision-making skills of the participants. A total of 15 points was assigned to this stage which was concerned with the assessment of the scene of the incident/the injured, being able to explain the purpose of the practices that are performed, and determining priorities. As known, it is vitally important for the first aider to determine the priority patients and practices in case of an incident. Especially the 4-minute period that starts with the halting of the respiratory and cardiovascular functions of the injured/patient is known as

the 'golden time', irreversible injuries start in brain cells by the 10th minute. [17-20] This is why it was also significant that this study assessed these steps.

The *second stage* was also assigned 15 points, and it consisted of the steps of applying first aid practices in the correct order and determining the appropriate method of transporting the patient/injured. The success scores of the participants during the face-to-face implementations were also given the same way. In both methods, the time of application was limited to a minimum of 5 minutes and a maximum of 15 minutes.

Guideline for Applying Learning Skills: This form was prepared based on the up-to-date literature for making it easier for the participants to see first aid practices step by step. [17-20,29] In the form, the steps of first aid were written down one by one, and the participants were expected to perform these steps in the correct order. The participants' implementation of these steps was assessed by a score of 3 for 'failed to perform', 2 for 'performed (needs improvement)', and 1 for 'performed'. With this assessment method, it was aimed to help the participant determine their own self-efficacy. The application success score of the participant was calculated as specified in the Instruction Form for Preparing Application Videos.

2.4. Implementation

The study was completed in three stages. At the first stage, at the beginning of the semester, the participants were given the Instruction Form for Preparing Application Videos and the Guideline for Applying Learning Skills. The Guideline was given early in the process for preparing the participants for the first aid practices and allowing them to reinforce the theoretical topics of the classes with practices. Additionally, in the Instruction Form, the scoring scheme of the first aid practices was explained clearly, and it was stated that the scores the participants would obtain would show their applied success grade for the course. The total applied success grade of the course was determined to be on a scale of 0 to 60 points. In this grade, 30 points were allocated to the video assignment the participants would send in the second stage of the study, whereas the remaining 30 points were allocated to the implementation they would make in the laboratory in the third stage. The data of the study were collected between 21.05.2021 and 18.06.2021, starting with the reception of the first video assignment, and the study was completed in three stages.

2.4.1 First stage

In the *first stage*, the theoretical and practice parts of the First Aid and Emergency Care Nursing course were taught through distance education with online classes theoretically and with appropriate educational videos. The application video for each practice was shown at the end of the theoretical class, and it was aimed to reinforce the information to provide learning skills. The first aid practice to be taught by each instructor was determined before the classes started. In the distance education and face-to-face implementations, the same instructor taught and showed the first aid practices and instructed the participants to apply them.

2.4.2 Second stage

In the *second stage*, the participants were instructed to perform a first aid practice in line with the Guideline for Applying Learning Skills with the steps specified in the Instruction Form for Preparing Application Videos and record it on video. The participants uploaded the videos they recorded via the institutional distance education system of the university. The completed video assignments were evaluated by the instructor who taught the respective practice during the distance education process.

2.4.3 Third stage

In the *third stage*, the first aid practices were taught by the instructors of the course in the laboratory environment in an applied, face-to-face manner. At this stage, the participants were asked to perform the practices after the instructors did.

Before the participants arrived for face-to-face education in the laboratory environment, the laboratory schedule was planned in line with pandemic-related precautions. There were two laboratories in total. According to the pandemic period rules, a maximum capacity of 10 people was allocated for either laboratory. The participants were divided into 8 groups, and the numbers of participants in the groups were allocated as 8, 8, 8, 8, 9, 9, 9, and 9. The laboratory to be used by each group, the date and hour of the application, and information on the instructors were determined beforehand. Due to the requirements of the pandemic rules, the students took part in their applied classes in the same laboratory which was assigned to them for their practice implementations. Moreover, the time allocated for the practices during the theoretical instruction of the class was the same as the time allocated for the same practices in the laboratory. Table 1 shows the applied education sessions, instructors, and durations in the face-to-face education part of the study. The participants received training on all first aid practices and performed these practices simultaneously in the laboratory. Within the scope of the study, among the practices performed by the participants in the laboratory environment, only the practices performed in the video assignment were considered for analysis.

Table 1. Education sessions, instructors, and application times

Sessions	Instructor	Application Time
Basic life support Coma position Heimlich maneuver	Instructor 1	4 hours
First aid practices in traumas (head-spine, chest and abdominal injuries)	Instructor 2	4 hours
First aid practices in bleeding cases, Shock position		2 hours
Patient transport techniques		1 hour
Identification of fractures	Instructor 1	3 hours

2.5. Statistical analysis

The data were analyzed using the SPSS 16.0 program. Shapiro-Wilk test was used to test the normality of the distribution of the data. Descriptive statistical analysis included frequencies, percentages, means, standard deviations, minimum values, and maximum values. The application scores of the participants obtained in the course during the distance education and face-to-face education processes were analyzed using a paired-sample t-test. The sociodemographic characteristics of the participants were compared to their distance education and face-to-face education application scores by using an independent-sample t-test, one-way analysis of variance (ANOVA), and Pearson's correlation analysis. The results were interpreted within a 95% confidence interval, and $p<0.05$ was accepted as statistically significant.

Ethical considerations

For this study, approval from the Social Sciences and Humanities Ethics Committee of Bartın University (dated 31/05/2021, numbered 2021/09) and written permission from the institution where the study would be conducted were obtained. The participants were informed about the objective of the study and other necessary details, and their consent was received.

3. Results

The descriptive statistics of the sociodemographic characteristics of the participants and their application scores are presented in Table 2. The mean age of the participants was 20.64±0.91 years, 69.1% were female, and 31.9% were male. While 26.5% of the participants stated that they had previously received education on first aid, 55.5% of those who had received such education said they had this education during their high school education. Among these participants, one-half stated that they received first aid education before 2018, whereas the other half said they received first aid education after 2018. It was found that 10.3% of the participants were working, and among those who were working, only 14.2% took part in a health-related area at their workplace (Table 2).

Table 2. Sociodemographic characteristics of the participants

Sociodemographic characteristics	n	%	
Gender			
Female	47	69.1	
Male	21	31.9	
Has received first aid education			
Yes	18	26.5	
No	50	73.5	
Source of first aid education			
Driving school	7	38.8	
High school education	10	55.5	
Certificate Program	1	5.7	
Time of receiving first aid education (between 2015 and 2019)			
Before 2018	9	50.0	
In or after 2018	9	50.0	
Working			
Yes	7	10.3	
No	61	89.7	
Duty at the workplace			
Health-related	1	14.2	
Not health-related	6	85.8	
	X±SD	**Age Range**	**Median**
Age	20.64±0.91	19-22	23

The difference between the scores of the participants in the assessment of their applied assignments given during distance education and their scores in the assessment of their practices in their face-to-face applications was statistically highly significant ($p<0.001$). After the face-to-face application, the first-stage, second-stage, and third-stage scores of the participants increased (Table 3).

Table 3. Comparison of the application scores of the participants after distance and face-to-face education

Application score	X±SD	Min.-Max.	Median	t	p[a]
Total scores					
After distance education	20.35±2.80	15-29	20	-17.25	**< 0,001**
After face-to-face education	26.70±1.78	22-30	27		
1st stage scores					
After distance education	11.22±1.36	8-15	10	-12.36	**< 0,001**
After face-to-face education	13.54±1.08	11-15	13		
2nd stage scores					
After distance education	9.11±2.06	5-15	9	-15.33	**< 0,001**
After face-to-face education	13.11±1.28	10-15	14		

[a] *Paired-samples t-test*

There was no statistically significant relationship between the application scores of the participants after distance education and their sociodemographic characteristics (Table 4).

Table 4. Comparison of the sociodemographic characteristics of the students and their application scores after distance education

Sociodemographic characteristics	Application score (X±SD)	Statistical test	p
Gender			
Female	20.74±2.70	1.749	0.085[a]
Male	19.47±2.89		
Has received first aid education			
Yes	20.83±3.03	0.845	0.401[a]
No	20.18±2.73		
Source of first aid education			
Driving school	20.42±4.39	0.577	0.573[b]
High school education	20.80±1.81		
Certificate Program	24.00		
Working			
Yes	20.14±3.53	-0.208	0.836[a]
No	20.37±2.74		
Duty at the workplace			
Health-related	22.00	0.533	0.617[a]
Not health-related	19.83±3.76		
Age		-0.003	0.980[c]

[a] *Independent-samples t-test,* [b] *One-way ANOVA,* [c] *Pearson's correlation analysis*

There was no statistically significant relationship between the application scores of the participants after face-to-face education and their sociodemographic characteristics (Table 5).

Table 5. Comparison of the sociodemographic characteristics of the students and their application scores after face-to-face education

Sociodemographic characteristics	Application score (X±SD)	Statistical test	p
Gender			
Female	26.59±1.83	-0.784	0.436[a]
Male	26.95±1.46		
Has received first aid education			
Yes	27.22±1.55	1.492	0.141[a]
No	26.52±1.76		
Source of first aid education			
Driving school	27.57±1.98	0.485	0.625[b]
High school education	26.90±1.28		
Certificate program	28.0		
Working			
Yes	25.57±1.27	-1.867	0.066[a]
No	26.83±1.73		
Duty at the workplace			
Health-related	27.00	1.274	0.259[a]
Not health-related	25.33±1.21		
Age		-0.048	0.698[c]

[a] *Independent-samples t-test,* [b] *One-way ANOVA,* [c] *Pearson's correlation analysis*

4. Discussion

In this study, there was a statistically significant difference between the application success scores of the students who took the First Aid and Emergency Care Nursing course with two different methods as distance education and face-to-face education. The application success scores of the participants increased after they took an active part in the face-to-face classes in the laboratory ($p<0.001$). Additionally, for both instruction methods, the sociodemographic characteristics of the participants were not effective in their success scores ($p>0.05$). This finding was important in terms of showing that the change that was found in the success scores of the participants originated only from the instruction methods. Although studies in the literature which provided an applied course to nursing students during the pandemic period and compared their success scores in two different methods of instruction are highly limited, the result in this study was compatible with those reported in similar studies. [30-33] In the study they conducted to determine difficulties experienced in nursing practices during the COVID-19 pandemic period, Liu et al. determined educational areas (satellite campuses) where students would take applied classes at a separate location. They found that the students had higher satisfaction levels with the application environments and the instructors. Additionally, the results of the qualitative data analyses they conducted showed that the nursing students gained significant knowledge and experience on the campuses, and they shared positive comments about their experiences. [30] Accordingly, it may be concluded that holding applied classes face-to-face will increase the success, experience, and satisfaction levels of students.

Another study determined that COVID-19 anxiety created a negative effect on the acquisition of occupational identity. This result was explained by the view that students take part in classes while they are experiencing concerns about their health, and they think they are not gaining qualifications in their application skills with this mindset. [31] Nevertheless, in addition to many psychological factors, success scores/grades play a significant part in the acquisition of occupational identity. [15] Therefore, in the process of providing students with occupational identity, it is highly important to teach practices effectively despite their concerns about Covid-19.

In this study, while the mean score of the participants after their face-to-face classes was 26.70 over 30 points, their mean score after their online distance education classes was 20.35. It is seen that the application success scores of the participants increased noticeably following face-to-face education. Thus, for preventing the job performance of nursing students starting their jobs after graduation from being affected, planning processes regarding orientation and in-service training opportunities at the beginning of the duties of students graduating around these times may differ. Accordingly, it is needed to investigate the topic of the occupational qualifications and attitudes of nursing students receiving education in this pandemic period regarding the pandemic.

In a systematic review, studies where nursing students were provided with blended education (distance education and satellite campuses), and their success levels were tested (studies in the period of 2005-2015) were examined. According to the authors, when blended education is used to manage and support distance education, it may affect the success of students in a positive direction. They also stated that there is a need for more studies on the effectiveness of education programs offered at satellite campuses for nursing students to help the improvement of future education practices. [34] With the effect of the COVID-19 pandemic, an increase has been observed in the number of studies conducted to investigate the effectiveness of blended education in nursing. According to the literature, blended education influences the course success of students in a positive direction. [32,33] Today, due to the ongoing pandemic conditions, the importance of satellite campuses is acknowledged even further. In our study, an implementation similar to the blended education model was carried out. The success scores

of the participants increased in face-to-face practices after distance education. Therefore, it may be seen that our findings were compatible with others reported in the literature.

The active participation of students in applied classes with face-to-face education in the classroom environment helps them gain the skills to re-formulate problems. This is because their inability to practice digital resources and take part in application-oriented discussions reduces their knowledge acquisition and critical behavioral skills. [28] Therefore, this study also aimed to measure the skills of the nursing students in making decisions in critical moments and approaching issues critically (triage, an organization at the scene of the incident, and among individuals). In this study, it was observed that the scores of the participants regarding critical thinking and critical decision-making increased after the application stage in the face-to-face education part of the study ($p<0.001$). Son (2020) also determined that providing learning for nursing students through laboratory simulations increased their learning attitudes and critical thinking behaviors significantly in comparison to distance education ($p<0.01$). [35] These results emphasize the importance of face-to-face education in instruction processes about first aid and emergency care courses in nursing education. Nevertheless, considering the ongoing pandemic conditions, it is believed that applying the blended education model will be useful.

Contributions of the Study to Nursing Practices

It is vital that face-to-face practices are not disrupted in nursing education in special conditions such as pandemics. In this context, different learning strategies are tried to be developed. With this study, the benefits of blended training in special conditions were seen and the study could be an exemplary training program for trainers.

Limitations

This study was carried out based on one applied course. Accordingly, the results may be strengthened by conducting studies with multiple courses in consideration. As this study was conducted with students registered for the First Aid and Emergency Care Nursing course at a university, studies to be carried out by including other applied courses may also utilize larger samples.

5. Conclusion and Recommendations

As uncertainties about the COVID-19 pandemic were still going on at the time of conducting this study, it is believed that this study will be guiding the teaching of applied courses in undergraduate nursing programs. Although web-based educational videos were utilized in this study after the theoretical instruction during the distance education process, this did not create the same success levels as those in face-to-face education. Therefore, for nursing students to be more active and qualified in practices and applications despite the ongoing pandemic period, face-to-face education is important. While preparations for transitioning back to face-to-face education continue in Turkey and other countries, infrastructure arrangements for nursing students to actively take part in applied classes in compliance with rules brought about in relation to the pandemic should be completed fast. In cases where face-to-face practices are not possible, it will be beneficial for students to receive support from resources such as simulated clinical environments and virtual reality scenario cases to improve their skill qualifications and learning outcomes. Nevertheless, in cases these simulation practices that are costly cannot be implemented, it is considered that the learning processes of students in the laboratory environment in small groups as in our study would be sufficient.

Interruptions in face-to-face education programs in extraordinary conditions such as a pandemic may also be in question in the future. This is why there is a need for studies where blended education models will be used in the strategic planning of educational activities. It is recommended that researchers conduct experimental studies on this topic with larger samples.

Ethical statement

For this study, approval from the Social Sciences and Humanities Ethics Committee of Bartın University (dated 31/05/2021, numbered 2021/09) and written permission from the institution where the study would be conducted were obtained. The participants were informed about the objective of the study and other necessary details, and their consent was received.

Acknowledgment

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Authors' Contributions

Conceptualization: S.Ç, S.A., Ö.U.; Research design: S.Ç., S.A., Data collection and/or processing: S.A., Ö.U.; Analysis and/or Interpretation: S.Ç., E.K.; Literature Review: S.Ç., E.K., S.A., Ö.U; Writing up the original draft: S.Ç., A.A.; Review and Editing: S.Ç., E.K., S.A., Ö.U

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Research Article

A RURAL-URBAN COMPARISON OF PERFORMANCE-BASED PRIMARY HEALTH CARE SERVICES IN ERZURUM

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Abstract: *Family physicians in Turkey apply to the provincial health directorate every month with performance exception forms reporting the performance-linked preventive health services they could not provide to avoid penalty deductions from their monthly pay. This form is a good tool for evaluating the reasons that preventive health care cannot be provided. The aim of this study was to examine rural-urban differences in performance-based service data and evaluate the reasons physicians are unable to provide service. We retrospectively evaluated 4187 performance exception forms sent to the provincial health directorate by family physicians between 2019 and 2021. The preventive health service not provided, the reason specified by the family physician, the year, and whether the setting was rural or urban were noted. Categorical data were summarized as frequency and percentage, numerical data as mean and standard deviation or median and range. The chi-square test and Mann-Whitney U test were used to compare the data. Between 2019 and 2021, there were 2553 applications from urban areas and 1634 applications from rural areas. There were significantly fewer applications from rural areas. During this period, disruptions in immunization services were most frequent (61.1%), with a significantly greater frequency in urban (65.5%) than rural (54.3%) settings. Nearly one-third of service disruptions were attributed to migration out of the family physician's service area. The most common reason reported for immunization service disruption was vaccine refusal (47.6%). Vaccine refusal and migration were identified as the main barriers to the provision of preventive health services. Although the global struggle against vaccine rejection continues, national legislative changes should be implemented to prevent a simple factor such as migration from interrupting health services in our country.*

Keywords*: family practice, immunization, incentive reimbursement, preventive health services, primary health care*

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1. Introduction

Effective provision of primary health care (PHC) is among the priorities of a country [1, 2]. The family practice model is one of the most frequently employed service delivery models for this purpose. However, there are international differences in the implementation and remuneration methods used in this model.

In Turkey, public health services such as environmental health services and infectious disease tracking have been carried out by community health centers since 2010. Personalized services are provided by general practitioners and family medicine specialists, called family physicians (FP), using a list-based approach. Infant-child, pregnant, and puerperant follow-ups, immunization and other preventive health services, primary care diagnosis, and treatment services are provided by FPs within the PHC. A composite method was adopted in the remuneration of family physicians. Compensation is determined according to several components, including the number of people, performance-based (PBS) services, the level of socioeconomic development in the area, expenses of the family health center, and mobile health service. Vaccines in the extended immunization program, antenatal follow-up, and infant/child follow-up were included in performance-based pay. In addition, mobile services were defined for areas without nearby health centers. These practices facilitated access to health services and aimed to ensure these services were not neglected [3, 4].

Despite these efforts, however, service disruptions sometimes occur. If the service is based to performance, the disruption will result in a penalty deduction from the family physician's pay. In such a case, the family physician submits a performance exception form each month explaining the reasons for the disruption to the health directorate. These applications are evaluated by a commission. If accepted, no deduction is made from the physician's pay.

This method of preventing deductions from performance-based compensation is one of the unique features of the family medicine model applied in our country. These exception forms also enable the identification of barriers to the provision of preventive health care services. However, there is no previous study examining these forms in the literature.

The aim of the present study was to investigate rural-urban differences in performance-based PHC service data in the Erzurum province in the Northeast Anatolia Region of Turkey and to evaluate the reasons for the inability to provide these services.

2. Materials and Methods

This retrospective cross-sectional study included 4 187 performance exception forms submitted by FPs to the Erzurum Provincial Health Directorate as a basis for performance-based compensation in the years 2019 through 2021.

The study was approved by the Clinical Research Ethics Committee of the Erzurum Regional Training and Research Hospital on 18.04.2022 (Erzurum BEAH KAEK 2022/05-44). The study was conducted in accordance with the principles of the Declaration of Helsinki.

2.1. Study setting

The Erzurum province is in the northeast of Turkey. According to the socio-economic development index, it ranks 61st among 81 provinces [5]. It has a surface area of 25,006 km², making it the fourth-largest province in Turkey in terms of area [6]. According to data from the General Directorate of Meteorology, it is also one of the coldest provinces in Turkey, with an average annual temperature of 5.7°C [7]. Rural areas are difficult to access because of snow in the winter months, rely on coal for domestic heating, and are less preferred by FPs. Therefore, starker rural-urban differences are expected in the province. Of the 20 districts within the province, the 3 central districts (Yakutiye, Palandoken, Aziziye) are in the first or third development tier, while the 17 peripherally located districts (the most remote district is 180 km from the center) either have smaller populations or a lower development level [8]. According to 2021 data, the literacy rates were 97.57% among the population living in the 3 urban districts and 92.47% among those in the 17 rural districts [9]. Selected characteristics of Turkey and the Erzurum are presented in Table 1.

Table 1. Comparison of selected characteristics of Turkey and Erzurum, 2019–2021 [9, 22-24].

Variable	Turkey			Erzurum		
	2019	2020	2021	2019	2020	2021
Population (n)	83 154 997	83 614 362	84 680 273	762 062	758 279	756 893
Female population (%)	49.8	49.9	49.9	50.1	50.1	50.1
Proportion of females aged 15–49 years (%)	25.9	25.8	25.8	26.5	26.3	26.4
Proportion of population aged 0–14 (%)	23.1	22.8	22.4	25.6	25.3	24.8
Older population (%)	9.1	9.5	9.7	8.7	9.1	9.4
Population growth rate (‰)	13.9	5.5	12.7	-7.6	-4.9	-1.8
Crude birth rate (‰)	14.4	13.3	12.8	19.9	15.8	15.2
Total fertility rate (n of children)	1.9	1.8	1.7	2.1	2.0	1.95
Number of live births (n)	1 183 652	1 112 859	1 079 842	12 929	12 029	11 510
Infant mortality rate (‰)	9.0	8.5	9.1	9.7	10.1	11.2
Mortality rate in children under 5 years of age (‰)	11.1	10.6	11.1	11.9	12.1	13.6
BCG vaccination coverage among infants (%)	96	96	95	99	99	99
MMR vaccination coverage among infants (%)	97	95	96	98	98	99
HBV-3 vaccination coverage among infants (%)	99	98	96	99	99	99
Maternal mortality rate (per 100,000)	13.1	13.1	13.1	15.4	8.3	8.3
Illiteracy rate among population over 15 years old (%)	3.1	2.9	2.8	5.9	5.6	5.3
Number of family physicians (n)	26 476	26 594	25 611	274	271	272
Average population per family physician (n)	3 141	3 144	3 306	2 781	2 798	2 783

BCG: Bacillus Calmette-Guerin, MMR: Measles, mumps, rubella, HBV: Hepatitis B virus

2.2. Family medicine practice

The family practice model in Turkey has been explained in detail in numerous publications [1, 3, 4, 10, 11]. All health services are overseen by the Ministry of Health (MoH), resulting in uniform practices nationwide. Provincial health directorates are responsible for ensuring that services are provided as instructed by the MoH [3, 4, 11].

The compensation received by FPs is dependent on several variables [12]:

i) Main payment based on the number of persons registered to the physician and the characteristics of these people.

ii) Penalty deduction in case of failure to provide appropriate preventive health services (follow-up and immunization) for priority groups with different coefficients (PBSs);

iii) Additional pay according to the socioeconomic development index of the district where they work;

iv) Reimbursement of costs associated with the operation of the family health center (FHC); and

v) Reimbursement of mobile health care expenses, if applicable.

The FP's compensation is determined from the sum of these variables. Among those registered to a physician, pregnant people, prisoners and convicts, children aged 0-59 months, and adults over 65 years of age are multiplied by a higher coefficient when included in this total. Follow-up and immunization with vaccines included in the extended immunization program offered to this priority

group are included in performance-based compensation. The objective is complete or near-complete provision of these services, or reductions are made from the FP's pay. FPs can see whether there is a failure to provide services in the family medicine information system and MoH system. Each month, they explain the reasons for this failure to the performance exception commission in the provincial health directorate and object to the pay deduction. A form structured by the Ministry is used to file for exceptions. The commission evaluates whether the documents specified by the Ministry are complete and then evaluates the physician's statement. If deemed to be justified, an exception is granted and no deduction is made. If not, the corresponding amount is deducted from the physician's salary [4, 12]. Therefore, performance exception applications are a good source of data on both the areas of deficient preventive health services and the reasons for these deficiencies.

2.3. Data collection

Performance exception forms sent by FPs to the provincial health directorate every month are evaluated by the commission and these documents are retained. In this study, we retrospectively reviewed 4187 forms from 2019, 2020, and 2021 held by the provincial health directorate. There were 277 duplicate applications in 2019, 248 in 2020, 231 in 2021, and 751 in total. From the records, we collected and analyzed data pertaining to:

- the district,
- the family medicine unit,
- the PBS that could not be provided,
- If this service was immunization, the vaccine was not administered,
- the reason for not providing the service, and
- additional statements, if any.

The form used to file for performance exception by the Ministry contains four main headings: i) Antenatal follow-up, ii) Infant follow-up, iii) Child follow-up, and iv) Immunization.

After all applications were evaluated under these four main headings, any information provided by the physicians in additional statements was also noted. We also classified these explanations under general headings as follows: no-shows, vaccine refusal, late detection of pregnancy, migration, refusal of follow-up, service provided outside the performance dates, system error, and medical indication.

2.4. Definitions

No-shows: This category included all cases in which the family/person did not present to the FHC despite the FP informing them about the follow-up or vaccination.

Vaccine refusal: Cases where the family of an infant/child did not consent to the administration of vaccines in the extended immunization program. In such cases, the parent signs a form stating that they refuse the vaccine.

Late detection of pregnancy: At least 4 antenatal follow-up visits are mandatory in primary care. If pregnancy is not detected within the first 12 weeks, the first antenatal follow-up cannot be performed. This was among the reasons cited for the inability to perform the first antenatal follow-up.

Migration: The service could not be provided because the registered person moved out of the service area of the FP or was not present in the service area (e.g., was on vacation) when the follow-up/vaccination was required.

Refusal of follow-up: There may be situations where the person does not consent to antenatal or infant/child follow-up. In this case, the pregnant person or parents of the infant/child sign a form stating that they refuse follow-up.

Service provided outside the performance dates: All follow-up and vaccine administration times are determined by software (as a date range) according to the person's birthdate or the date of the last

menstrual period if pregnant. If a service was provided before or after this date range, it was included under this heading. Possible reasons for this include the measles vaccine being administered after contact with a measles patient, the tetanus vaccine being administered after a contaminated injury, or vaccination having to be delayed due to medical problems.

System error: Although health records software is used by both FPs (the Family Practice Information System) and the MoH (National Health System), differences may arise in the software of these two parties. For this reason, despite the FP having performed follow-up or immunization, it may appear in the Ministry system as if it has not been performed. Although very rare, sometimes even if the physician sends a record of the procedure to the Ministry's information systems through the data management system they use, a disruption in data transmission between the systems may occur. Such disputes were grouped under this heading.

Medical indication: This category includes cases where the general health of the infant/child precluded vaccination. This may also include acute diseases or hospitalizations. As pregnant women receiving inpatient treatment due to the threat of preterm birth cannot undergo antenatal follow-up by the FP, these instances are included under this heading.

Urban: The three districts in the center of the province (Yakutiye, Palandoken, and Aziziye) were regarded as "urban" because they are in the first or third development tier [8].

Rural: The 17 peripheral districts were considered "rural" because they have a smaller population (328,591) and lower development level (5 or 6), and are also regarded as rural in public service provision [8].

Mobile health services: Health services are provided by the FP in the community by going to locations such as towns, villages, hamlets, and remote settlements. In the Erzurum, FPs provided mobile health services to 157 795 people in 2021, 163 911 people in 2020, and 171 314 people in 2019 living in locations that are difficult to reach and are not located in the province/district center. A total of 27 FPs serving urban areas and 119 FPs in rural areas are obligated to provide mobile services.

2.5. Statistical analysis

All analyses were performed using SPSS Statistics version 20.0 (IBM Corp, http://www.spss.com). Categorical variables were summarized as frequency and percentage; numerical variables as mean and standard deviation or median and range. Categorical data were compared using the Chi-square Goodness of Fit Test, Chi-square test, followed by post-hoc Bonferroni correction. Mann-Whitney U test was used to compare the number of applications filed in rural and urban areas. A p-value <0.05 was considered statistically significant.

Ethical statement

The study was approved by the Clinical Research Ethics Committee of the Erzurum Regional Training and Research Hospital on 18.04.2022 (Erzurum BEAH KAEK 2022/05-44). Owing to the retrospective nature of the study, the need for informed consent was waived. The study was conducted in accordance with the principles of the Declaration of Helsinki.

3. Results

A total of 4 187 performance exception forms submitted in the years 2019–2021 were evaluated. During this period, there were 2 553 applications from 147 units serving the urban center. The mean number of applications per unit was 17.4±1.6 (median, 12; range, 0-162). In the same period, there were a total of 1634 applications from rural areas. As there are 127 units serving rural areas, the mean number of applications per unit in these three years was 12.9±1.1 (median, 9; range, 0-74). There were significantly fewer applications from rural areas ($p=0.015$). However there was no statistically significant difference between the number of applications by years ($p>0.05$).

Table 2 shows the distribution of performance exception requests by year. In all three years, immunization-related service disruptions in urban areas significantly outnumbered those in rural areas ($p<0.001$). In addition, there were significantly more disruptions in infant follow-up in rural areas during 2021 ($p<0.001$).

Table 2. Distribution of health services reported in performance exception applications by year in Erzurum, 2019–2021.

		Antenatal Follow-up	Infant Follow-up	Child Follow-up	Immunization	Total	p*
2019	Rural n (%†)	117 (22.7)	62 (12.0)	111 (21.6)	225 (43.7)	515 (100)	<0.001
	Urban n (%†)	128 (15.8)	56 (6.9)	169 (20.9)	457 (56.4)**	810 (100)	
	Total n (%†)	245 (18.5)	118 (8.9)	280 (21.1)	682 (51.5)	1325(100)	
2020	Rural n (%†)	93 (15.9)	65 (11.1)	90 (15.4)	336 (57.5)	584 (100)	<0.001
	Urban n (%†)	101 (11.6)	61 (7.0)	131 (15.1)	575 (66.2)**	868 (100)	
	Total n (%†)	194 (13.4)	126 (8.7)	221 (15.2)	911 (62.7)	1452(100)	
2021	Rural n (%†)	71 (13.3)	74 (13.8)**	64 (12.0)	326 (60.9)	535 (100)	<0.001
	Urban n (%†)	92 (10.5)	33 (3.8)	111 (12.7)	639 (73.0)**	875 (100)	
	Total n (%†)	163 (11.6)	107 (7.6)	175 (12.4)	965 (68.4)	1410(100)	
General	Rural n (%†)	281 (17.2)	201 (12.3)	265 (16.2)	887 (54.3)	1634 (100)	<0.001
	Urban n (%†)	321 (12.6)	150 (5.9)	411 (16.1)	1671 (65.5)	2553 (100)	
	Total n (%†)	602 (14.4)	351 (8.4)	676 (16.1)	2558 (61.1)	4187 (100)	

*Chi-square **Statistically significant variable † Raw percentage

Table 3 shows the grounds for performance exception claims related to antenatal follow-up by year. There were problems with at least one follow-up visit of 209 pregnant women in 2019, 165 pregnant women in 2020, and 141 pregnant women in 2021 when considered singular because there was duplicate data in the table. The most common reason cited for the inability to perform antenatal follow-up was migration, which was more frequent in applications from rural areas. Of these, 223 follow-up visits were not performed because the person migrated out of the service area. For 52 missed follow-ups, address information was not available for the pregnant person. Detailed explanations regarding the late detection of pregnancy in particular were as follows: 31 urban and 40 rural follow-ups could not be performed because the FP was not notified of the pregnancy; 17 urban and 16 rural follow-ups were missed because the pregnant person did not present to the FHC; 10 urban and 4 rural follow-ups were not performed because the person did not realize they were pregnant; 2 urban and 1 rural follow-up were for pregnant adolescents; and in 6 urban and 1 rural follow-up, the pregnancy was not detected because either the FP or the pregnant person was new to that unit.

Table 3. Distribution of reasons for performance exception applications related to antenatal follow-up by year in Erzurum, 2019–2021.

Antenatal follow-up	2019		2020		2021		Total
	Urban n (%*)	Rural n (%*)	Urban n (%*)	Rural n (%*)	Urban n (%*)	Rural n (%*)	n (%*)
Preferred a (private/public) hospital	3 (2.3)	1 (0.9)	2 (2.0)	5 (5.4)	1 (1.1)	0	12 (2.0)
No-show	4 (3.1)	2 (1.7)	6 (5.9)	1 (1.1)	5 (5.4)	0	18 (3.0)
Late detection of pregnancy	35 (27.3)	26 (22.2)	20 (19.8)	20 (21.5)	27 (29.3)	20 (28.2)	148 (24.6)
Migration	62 (48.4)	69 (59.0)	42 (41.6)	47 (50.5)	40 (43.5)	37 (52.1)	297 (49.3)
Refusal of follow-up	7 (5.5)	4 (3.4)	3 (3.0)	0	9 (9.8)	4 (5.6)	27 (4.5)
System error	16 (12.5)	15 (12.8)	28 (27.7)	20 (21.5)	9 (9.8)	10 (14.1)	98 (16.3)
Medical indication	1 (0.8)	0	0	0	1 (1.1)	0	2 (0.3)
Total	128(100)	117(100)	101(100)	93 (100)	92 (100)	71 (100)	602 (100)

*Column percentage

Table 4 shows FPs' reasons for claiming performance exceptions for the inability to perform infant follow-up by year. At least one follow-up was missed for 84 infants in 2019, 102 in 2020, and 84 in 2021 when considered singular because there was duplicate data in the table.". Of these, 147 follow-ups were not performed because the infant migrated out of the service area. For 19 missed follow-ups, the physician had no information about the infant's location. Another 43 follow-ups could not be performed because the infant was receiving inpatient treatment and 3 were not performed for different medical reasons.

Table 4. Distribution of reasons for performance exception applications related to infant follow-up by year in Erzurum, 2019–2021.

Infant follow-up	2019		2020		2021		Total
	Urban n (%*)	Rural n (%*)	Urban n (%*)	Rural n (%*)	Urban n (%*)	Rural n (%*)	n (%*)
No-show	1 (1.8)	0	4 (6.6)	5 (7.7)	4 (12.1)	3 (4.1)	17 (4.8)
Migration	24 (42.9)	37 (59.7)	25 (41.0)	31 (47.7)	18 (54.5)	31 (41.9)	166 (47.3)
Refusal of follow-up	13 (23.2)	5 (8.1)	13 (21.3)	2 (3.1)	9 (27.3)	4 (5.4)	46 (13.1)
System error	14 (25.0)	9 (14.5)	14 (23.0)	20 (30.8)	1 (3.0)	18 (24.3)	76 (21.7)
Medical indication	4 (7.1)	11 (17.7)	5 (8.2)	7 (10.8)	1 (3.0)	18 (24.3)	46 (13.1)
Total	56 (100)	62 (100)	61 (100)	65 (100)	33 (100)	74 (100)	351 (100)

*Column percentage

Table 5 shows FPs' reasons for claiming performance exceptions for the inability to perform child follow-up. At least one follow-up was missed for 253 children in 2019, 204 children in 2020, and 160 children in 2021. Of these, 192 follow-ups were not performed because the infant migrated out of the service area. In 137 follow-ups, there was no address information for the child. Nine follow-ups were not performed because the child was receiving inpatient treatment.

Table 5. Distribution of reasons for performance exception applications related to child follow-up by year in Erzurum, 2019–2021.

Child follow-up	2019		2020		2021		Total
	Urban	Rural	Urban	Rural	Urban	Rural	
	n (%*)	n (%*)	n (%*)	n (%*)	n (%*)	n (%*)	n (%*)
No-show	0	0	6 (4.6)	0	1 (0.9)	6 (9.4)	13 (1.9)
Migration	123 (72.8)	85 (76.6)	84 (64.1)	61 (67.8)	77 (69.4)	44 (68.8)	474 (70.1)
Refusal of follow-up	20 (11.8)	6 (5.4)	22 (16.8)	6 (6.7)	16 (14.4)	4 (6.3)	74 (10.9)
System error	26 (15.4)	19 (17.1)	19 (14.5)	19 (21.1)	17 (15.3)	6 (9.4)	106 (15.7)
Medical indication	0	1 (0.9)	0	4 (4.4)	0	4 (6.3)	9 (1.3)
Total	169 (100)	111 (100)	131 (100)	90 (100)	111 (100)	64 (100)	676 (100)

*Column percentage

In the three-year study period, there were problems related to the administration of 519 hepatitis B, 199 BCG, 672 conjugated pneumococcal, 904 diphtheria-tetanus-acellular pertussis-inactive polio-*Haemophilus influenza* (DTaP-IPV/Hib), 507 oral polio, 259 chickenpox, 622 measles-mumps-rubella, 621 hepatitis A, 290 DTaP-IPV, and 313 Td vaccines to 1801 infants and children.

The distribution of reasons for performance exception requests related to immunization by year is shown in Table 6. Vaccine refusal was the most common reason for the inability to immunize and was more frequently reported in applications from urban areas. Of 1,218 vaccine refusals, 979 were reported from urban areas and 239 from rural areas. Reasons given by families refusing vaccination were mistrust of vaccines (n=169) and history of adverse effects after other vaccinations (n=17). No additional explanation was given for the other 959 vaccine refusals. In 67 instances of vaccine refusal, the family presented a medical reason.

Table 6. Distribution of reasons for performance exception applications related to immunization by year in Erzurum, 2019–2021.

Immunization	2019		2020		2021		Total
	Urban	Rural	Urban	Rural	Urban	Rural	
	n (%*)	n (%*)	n (%*)	n (%*)	n (%*)	n (%*)	n (%*)
No-show	1 (0.2)	1 (0.4)	17 (3.0)	4 (1.2)	9 (1.4)	6 (1.8)	38 (1.5)
Vaccine refusal	286 (62.6)	71 (31.6)	309 (53.7)	93 (27.7)	384 (60.1)	75 (23.0)	1218 (47.6)
Migration	83 (18.2)	70 (31.1)	105 (18.3)	97 (28.9)	138 (21.6)	111 (34.0)	604 (23.6)
Administered outside of designated date range	1 (0.2)	5 (2.2)	32 (5.6)	32 (9.5)	24 (3.8)	16 (4.9)	110 (4.3)
System error	56 (12.3)	50 (22.2)	76 (13.2)	83 (24.7)	64 (10.0)	72 (22.1)	401 (15.7)
Medical indication	30 (6.6)	28 (12.4)	36 (6.3)	27 (8.0)	20 (3.1)	46 (14.1)	187 (7.3)
Total	457 (100)	225 (100)	575 (100)	336 (100)	639 (100)	326 (100)	2558 (100)

*Column percentage

In addition, 464 vaccines could not be administered because the infant/child migrated out of the service area. Another 140 infants/children requiring vaccination had no address information. Also, 173 vaccines were not administered in terms of medical indications specified by the physician.

4. Discussion

This study examined the causes of the failure to provide PBS in family medicine practice in Erzurum. We also classified the districts of the province as rural and urban according to population and socioeconomic development index to evaluate whether there was a difference in service delivery. Our results demonstrate urban-rural discrepancies in the provision of preventive services. A greater number of applications for performance exceptions related to immunization were submitted from urban areas in all three years in the study period. In addition, there were significantly more disruptions in the follow-up of infants from rural areas in 2021.

A systematic review published in 2021 evaluated the effects of performance-based compensation in low- and middle-income countries. A few of the studies included in this review suggested that performance-based incentives could encourage healthcare providers to exert more effort to increase demand. The authors of the study conducted in Argentina reported that the timing of receiving antenatal care has been 1.5 weeks earlier with home visits [13]. In our study, we found that 602 antenatal follow-ups could not be performed for a total of 515 different pregnant women, but problems related to pregnancy detection were relatively infrequent. Another factor contributing to this relatively good result is that whenever the ICD diagnostic code of pregnancy is recorded in any health institution, the FP is also notified of this through the national information system. As a result of the mobile health services provided in rural areas, no-shows (defined in this study as people who did not present at all or despite being contacted) remained a less common problem. One of the reasons for the higher number of missed antenatal follow-ups in urban areas is likely the presence of a university hospital staffed by gynecology and obstetrics specialists, as well as a regional training and research hospital in the area. Pregnant women may have preferred to present to these institutions because PHC services do not have a gatekeeper role in our country, and people are free to go to the health institution they want [3]. In fact, it is understood from the additional statements made by the FPs that women prefer public or private hospitals over FHCs. In fact, it is understood from the additional statements made by the family physicians that women prefer public or private hospitals over family health centers. In a 2015 study evaluating the institutions where women received antenatal care, 87% of 242 pregnant women reported that they preferred a tertiary health institution in addition to the family health center, and 39% preferred private hospitals. Only 10% preferred primary family physicians [14]. Similarly, another study conducted in a tertiary hospital in the capital of Turkey showed that women most frequently presented to secondary or tertiary health institutions during pregnancy [15].

It was notable in our study that a large number of people knew they were pregnant but did not present to their FP or share this information with them. A sad finding was that some women do not realize they are pregnant. Unfortunately, adolescent pregnancies are another problem. As it is not legal for people under the age of 18 to marry in our country, such pregnancies are concealed, resulting in the inability to provide antenatal care. Taken together, this information suggests that physician-patient communication is not well established, reproductive health counseling is not effective or well provided, women of childbearing age (15-49 years) who are not included in performance-based compensation are not examined at least twice a year as mandated by the MoH, and women do not have sufficient health literacy to understand that they are pregnant. Considering the number of live births reported for the area (Table 1), the rate of pregnant women with incomplete antenatal care seems low, but it should be kept in mind that this study is only a quantitative evaluation. Given the high maternal and infant mortality rates in the province, it is clear that the quality rather than quantity of PBSs should be evaluated. This finding was also emphasized in a study evaluating the opinions of family physicians in western Turkey. A family physician stated that there were problems in the follow-up and detection of pregnant women, infants, and women aged 15-49 years with the family practice model implemented in our country [16].

List-based service provision leads FPs to ignore the provision of health care to people who are not on their own list. This is one of the main reasons behind the service disruptions in the migration category. In our study, more than one-third of all applications were related to migration. Although half of these applications were a result of migration out of the province, even moving within the province created a barrier to service provision. A study conducted in our country reported that FPs experienced problems in the provision of services to people who were not registered with them and that they did not want to do so [17]. The fact that a simple situation such as migration hinders access to health care shows that this is a pressing issue that must be addressed first.

A systematic review published in 2021 examined the impact of remuneration methods for healthcare professionals providing outpatient health services and determined that performance-based compensation was likely to increase the number of immunization services [18]. While most applications in our study were related to missed immunization services, the fact that the number of vaccine refusals reported in urban areas was three times higher than in rural areas in the three years studied may be a result of providing services near the rural dwellers registered with mobile services. This view is supported by the relatively low numbers of no-shows and families signing vaccine refusal forms in rural areas. Similar observations were also made regarding pregnancy detection and antenatal follow-up. In a Turkish qualitative study based on in-depth interviews, it was stated that the services of midwives working in family medicine can only be provided to those who present to the FHC [19]. The small urban population qualifying for mobile services may have caused these problems. It should also be remembered that in the country, these mobile services are also included in the compensation given to the family physician.

In a study conducted in Turkey in 2020, healthcare professionals reported that the most common reasons for vaccine refusal in the community were mistrust of vaccine contents (84%) and belief the vaccine would cause harm (71%) [20]. Our data support this finding when evaluated within the known cause and shows that our community also expresses vaccine mistrust. A study conducted in Istanbul during the COVID-19 pandemic showed that the number of infant and child examinations decreased despite population growth [21]. In contrast, our results indicate a decline in missed infant/child follow-up. We believe a contributing factor to this finding is that during the COVID-19 pandemic, some hospitals started serving only COVID-19 patients and people were hesitant to go to other hospitals, resulting in a shift to PHC. However, the disruption in immunization services continued to increase over the years. We surmise that increasing vaccine hesitancy had a role in this, as seen in the rest of the world [20].

Study limitations

The main limitation of this study is the lack of a qualitative component. As compensation based on quantitative indicators is preferred in our country at present, we conducted our study within this scope. Although the study did not include data from all provinces of Turkey, similar results can be expected because the family medicine system is implemented uniformly nationwide. However, the reasons cited by the family physicians may vary based on the characteristics of the population they serve. Another limitation is that the two-year period of the study coincided with the COVID-19 pandemic. The pandemic may have affected people's applications.

5. Conclusion

There is a clear difference in the provision of PBSs between rural and urban areas of the Erzurum. The fact that mobile health services are more common in rural than urban areas is likely one of the factors contributing to the numerical success achieved and increasing the accessibility of PHC. However, problems persist on issues such as immunization, which requires more intense effort from both physicians and the global community.

It is discouraging that service disruptions caused by migration constituted a substantial proportion of all applications, considering that this problem is easier to address and can be prevented. In the current system, it is not obligatory for people to register where they migrate, and FPs are not obligated to provide service to unregistered people. This leads to disruptions in the provision of PHC services and poses a threat to public health.

Considering the high infant and maternal mortality in the province and the deficiencies in follow-ups, policies should be developed to increase the quality and quantity of follow-ups. Also, public health literacy should be improved to increase public participation.

Ethical statement

The study was approved by the Clinical Research Ethics Committee of the Erzurum Regional Training and Research Hospital on 18.04.2022 (Erzurum BEAH KAEK 2022/05-44). Owing to the retrospective nature of the study, the need for informed consent was waived. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Acknowledgment

There is nothing to declare in this section.

Conflict of Interest

The authors declare that there are no conflicts of interest.

Authors' Contributions:

EFK, OT, BI conceptualized the study (33%).
EFK, OT collected the data (50%).
EFK, OK analyzed the data (50%).
EFK, OT, BI drafted the initial manuscript (33%).
EFK, OT, BI, OK, GB reviewed the manuscript, approved the final manuscript, and agreed to be accountable for all aspects of the work (20%).

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Review Article

USE OF ARTIFICIAL INTELLIGENCE IN HEALTH SERVICES MANAGEMENT IN TÜRKİYE

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Abstract: *With the inclusion of technological developments in the health sector, the importance given to artificial intelligence in the field of medicine is increasing. For the future, the application possibilities of artificial intelligence and especially the potential of big data are quite large. There are many uses for artificial intelligence applications in health services, such as surveillance systems, epidemiological analysis, detection of health risks, early diagnosis of diseases, epidemic management and vaccine studies. In addition, there are some potential positive and negative consequences of integrating artificial intelligence into modern medicine. The purpose of this review is to provide information about the concept of artificial intelligence and to evaluate the usage areas, potential benefits and aspects of artificial intelligence in Health Services from a perspective perspective through various application examples.*

Keywords*: Artificial intelligence, Artificial intelligence in healthcare, Artificial intelligence processes in healthcare*

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1. Introduction

Health institutions are multidisciplinary Deconstructions where a large number of health professionals work together, and cooperation prevails. With the development of technology, it is observed that technology has started to take an important place in health services. Along with the stages that the industry has passed, industry 4.0 is being mentioned today. However, the emerging public is being used to understand this change in 5.0 [1]. In parallel with the developments in the industrial revolutions, the transformation process in health follows a similar process and this situation is expressed as health 4.0 today [2]. For this reason, it is thought that it is important to have information about the stages of the industry in order to understand the digital transformation in health institutions. In the first industrial revolution, that is, in Industry 1.0, mechanical production facilities were started to be established with the use of water and steam power [3]. In the second industrial revolution, i.e. industry 2.0, the use of electrical energy and the diversion of this energy to the assembly line attract attention [4]. In the third industrial revolution, that is, in Industry 3.0, programmable machines began to be used in production, and the use of computers and the Internet became widespread [5].

Finally, industry 4.0, also called the fourth industrial revolution, aims to meet expectations at the highest level with rapidly developing technology opportunities [6]. Due to these developments, both the patient and today the health 4.0 period, which provides health services with technologies to inform the physician, has also started to show development [7]. With Health 4.0, attention is paid to issues such as

virtualization, personalization in health services, and improvement in the health industry under the influence of technology [8]. Today, due to many remarkable conditions such as increasing population, epidemics, and chronic diseases, health services are looking for new ways. With the effect of digitalization, it is thought that one of these ways is through artificial intelligence applications [9].

Artificial intelligence: is stated as the transfer of human characteristics such as thinking, decision-making, speech, visual perception, and interpretation to systems such as robots and computers through programs [10,11]. As in every field, artificial intelligence applications in health services are being discussed and discussed more and more every day [12]. In the field of artificial intelligence, and health it is seen that it is used for administrative and clinical purposes. In its use for administrative purposes, health management, documentation management, efficient use of hospital capacity, reduction of errors and irregularities, and cost and quality management can be considered situations such as [13]. In its clinical use, early diagnosis and emergency intervention, test result tracking and early intervention, imaging analysis tools, robotic surgery with artificial intelligence support, personalized treatment, post-treatment clinical decision support, drug treatment tracking, and drug development, care for the patient at the last stage of life are focused on situations such as [12,13,14]. It is stated that with the introduction of artificial intelligence in the field of health, some advantages and disadvantages will be encountered. First of all, there is the idea that artificial intelligence will not meet people's expectations of understanding and being understood [15]. However, it is thought that human-caused errors will be prevented by using artificial intelligence in the health field [16]. Despite these advantages, healthcare professionals are concerned about artificial intelligence for many reasons [13]. Due to the increasing elderly population all over the world, many countries are investing in this area by attaching importance to health-related artificial intelligence technologies [17]. With this review, it has tried to clarify the point of view of health administrators on artificial intelligence. it was written in order to provide a perspective point of view about the content of artificial intelligence and to share information about its use in the field of health.

2. The Concept of Artificial Intelligence

The concept of intelligence has been explained by the Turkish Language Association as "the ability of people to comprehend the facts, reason, and draw conclusions" [18]. Artificial intelligence is the name of the intelligence developed by the machine as an alternative to this "natural" personal intelligence. The ability of the machine to analyze and draw conclusions from the information it obtains by absorbing its surroundings, similar to a person, is called artificial intelligence [19]. While human intelligence develops with training and experience, machines can also have intelligence due to appropriate "training" and sufficient "experience". The algorithm is described as the steps to follow in troubleshooting a problem. Artificial intelligence consists of highly complex algorithms based on lean conditional expression. In a lean algorithm, a condition is defined to the machine, and the steps are explained one by one, such as what to do when the relevant condition is fulfilled and not. Machine learning, on the other hand, is a subset of artificial intelligence and relies on patterns and inferences produced as a result of algorithms and models [20].

Here, all algorithms are not written one by one by the programmer. Instead, the machine is taught a "training" set of sample data and inferences, and the model is created, allowing the machine to make predictions. In deep learning, which is an advanced stage of machine learning, learning similar to the nervous system is aimed [21]. The machine is taught information in the form of layers, enabling it to analyze the relationships of the information and create its own algorithm in advanced cases. In this way, the machine produces its own solution even in cases not defined by the software developer. Thanks to deep learning, it is possible to obtain results such as face recognition, voice recognition, and medical image analysis. Artificial intelligence, as it can be understood from these definitions, has a very

advanced learning ability and enables the computer to learn without the need for explicit coding through automatic extraction and analysis of complex data [22].

The computer learns from its mistakes and constantly improves. Moreover, if the appropriate data is provided, he/she can reach the ability to test the new knowledge he has acquired, to follow the success rate on his own, and to correct himself, if necessary, by forgetting the information he has learned. The biggest hesitations about the use of artificial intelligence in medicine are that the physician will take the decision-making stage and it cannot replace the human at this stage. However, as with other technological developments, the purpose of artificial intelligence is not to decide for the physician, but to support the physician in the decision-making process [23].

3. Artificial Intelligence Applications in Medicine

In the last 10 years, the number of studies on artificial intelligence in the field of medicine has increased considerably. Today, with cheaper storage possibilities and the increase in processing power, computers have the opportunity to reach the experience that a physician can gain throughout his life in seconds. Breast scanning is one of the main applications of artificial intelligence in radiological imaging. Due to the dense tissue of the breast, radiology reports prepared on mammogram results may differ and often require reinterpretation of images [24]. Artificial intelligence applications are preferred in the lesion category; It is based on making assumptions on pixels at the stage of distinguishing a tumor from normal tissue, malignant and benign lesions. With the image processing method, it is determined which pixels are normal parts of the relevant structure and which pixels are abnormal. Apart from breast imaging, there are systems that use automatic analysis algorithms in radiological acute ischemic imaging [25]. These systems help to detect thromboembolic vascular occlusions, infarct core, and potential infarct tissues at risk by evaluating computerized tomography and magnetic resonance imaging data together. As another imaging application, there are examples of the use of artificial intelligence with a success rate of 96% in the diagnosis of glaucoma [26]. Khorrami and his team conducted a study to utilize artificial intelligence applications to predict the response of non-small cell lung cancer patients to immunotherapy [27].

In the analysis performed on patient data in a retrospective approach, the differences in the CT models of tumor nodules before and after 2-3 cycles of treatment with machine learning were compared. The results suggest that the system can be used to explain patients' responses in the early stages of treatment. Tobacco et al. The WeCureX project, developed by WeCureX, is an artificial intelligence assistant application that aims to analyze and diagnose mental disorders through the answers given by the clients to the questions [28]. The application was created by training on the psychometric data of the patients and the diagnoses and evaluations of the patients. In the study, it was reported that the artificial intelligence assistant could reach the diagnosis with 97% accuracy over the data obtained. In the diagnosis of Alzheimer's, a mobile system has been developed that can make a successful diagnosis of more than 80% as a result of people drawing a clock on a digital screen and evaluating the drawings with artificial intelligence [29]. There are studies on artificial intelligence assistants that compete with dermatologists to diagnose nevus and are very successful [30]. Artificial intelligence applications are being developed in many areas such as systems that remind geriatric patients of medication hours, detection of Down syndrome through face images, and psychiatric diagnosis by semantic analysis method by transcribing speech into text. All these are just a few of the promising examples of artificial intelligence applications in the field of medicine, and they also make important contributions to issues such as genetic research, drug studies, and antibiotic resistance.

4. The Place of Artificial Intelligence in Healthcare Management

It is seen that artificial intelligence applications are needed to remove the conditions and negativities in the supply and management of health services, to bring the quality of health services to a better position, and to gain efficiency. These conditions are shown in the following headings [31].

4.1. 65^{+} Age Population Growth Condition in The World

The gradual increase in the number of people requires the operation of health care processes that require long-term treatment and care for the increasing 65+ age population. OECD data shows that the proportion of the 65+ age population in Finland in 2017 increased by 6.1% compared to 2000. Again in 2017, the total population ratio of 65+ increasing population in Turkey increased by 2.9% compared to 2000 [32]. According to OECD rates, it is understood that the population is aging both in Turkey and in the world. It is stated that TUIK's Life Tables increased 78.6 times between 2013 and 2015 [33]. According to 2017 OECD rates, there are 187 physicians per 100 thousand people in Turkey [34].In India, which has a population rate of 1.4 billion according to 2017 OECD rates, there are 78 physicians per 100 thousand people [32]. 6 is planned to be 25.6 by 2080 [32].

4.2. Condition of Diseases That Pose a Health Threat

In the report published by the World Health Organization (WHO) in 2019, 10 major health threats that could threaten human health worldwide were announced. In the report announced, air pollution, and viruses, which have increased with the growth of industry and technology, cause diseases to spread to the public due to inefficient health care services. The COVID-19 outbreak is an important public health problem that is being tackled all over the world. In addition, health problems increase due to insufficient drinking water and food due to socio-economic and cultural reasons. In the continuation of the report, heart diseases, cancer, diabetes, etc. It is stated that chronic diseases that are not contagious cause more than 70% of the losses in the world [35].

4.3. Low Standard of Living Quality Condition

One of the conditions that threaten people's health and cause them to be exposed to diseases is a low standard of living. In particular, the cause of death between the ages of 30-69 worldwide, consumption of cigarettes and alcoholic beverages is increasing. In addition, unhealthy diet, physical inactivity, and air pollution can cause [35]. In countries with low socio-economic conditions, access to food, drinking water, and hygiene products is limited due to low purchasing power or wars. To summarize briefly, responding to the increasing demand for health services challenges the health systems of countries.

4.4. Rise of Costs and Competition Condition

The prolongation of the average life expectancy of people over the age of 65 over the world causes high costs for long-term treatment processes. Implementing the current health policies of each country has become relatively difficult in the global world. One of the main reasons for this; is that unforeseen pandemics cause a large number of individuals to become ill and increase the demand for healthcare services. Health institutions with limited employment and capacity may be insufficient to meet the demand. In particular, vaccines and drugs required for treatment and protection studies require very high costs and a long time [36].

State and private hospitals that provide health services have to provide health services above a certain service quality. In order for health institutions to continue their existence as a business, they must have differences and superiorities in demand from their competitors. In such a case, it is inevitable to

benefit from artificial intelligence technologies as well as limited manpower despite the increasing number of patients [36].

4.5. Innovations in Informatics Technologies

As the internet develops and renews itself day by day, there is a digital transformation in the health sector as in many sectors. started to be preferred. One of the most crucial application areas of informatics technologies in health is artificial intelligence applications [37].

5. Applications of Artificial Intelligence In Healthcare Management

5.1. Uses of Artificial Intelligence for Management Purposes

- *General health process:* MHRS utilization rates, E-Pulse, etc. Applications to the hospital can be predicted using data, the length of stay and waiting times in the emergency services can be reduced, and ambulance access times can be standardized. Vaccines for babies can be followed and monitored.
- *Documentation process:* In electronic health record systems, health professionals' information can be rearranged, stored, and used. With Natural Language Development (DDG) tools, voice recordings and reports of physicians and healthcare professionals can be printed in a very short time with artificial intelligence-based processes.
- *Quality process:* Health institutions should not see the patient as a customer, unlike other procedures, while providing health services. In order for the health institution to maintain its currency, it must reduce the cost to be incurred and increase the quality of the service it provides. The Centerstone Research Institute has shown in a study that it is cheaper to diagnose using artificial intelligence than to reach a conventional conclusion. In this study, the results of the physical performances and conditions of 500 patients, who were named aimlessly, were compared with the decision-making models according to the artificial intelligence algorithm. As a result, it was revealed that there is a significant difference between the costs per unit.
- *Rational use of the capacity of health institutions:* It can be used for the possibility of rehabilitating the discharged patients as well as taking the empty bed capacity under instant control. Especially the increase in the number of patients in emergency services and the increase in the demand for these services recently necessitated the pre-calculation of the density. In one study, an application was designed by using the Long Short-Term Memory (LSTM) deep learning model, measuring the time-related emergency department density and calculating the number of patients per day for the following days and months. It may benefit the business in terms of the effective use of a limited number of beds in pandemics such as COVID-19.
- *Troubleshooting health services management:* It can be used to solve problems caused by reasons such as problems in archiving patient records and cyber-attacks. In the world, data related to health-related inputs, and applications used by people on the devices they carry, are designed as electronic health. Analyzing, archiving, and using big data created by health data requires finance and human effort. The Montefiore Health System in the USA, in collaboration with Intel, incorporated AI results and analysis to see common patterns in large amounts of patient data to more effectively serve a diverse patient population [37]. For this reason, it is possible to reduce the problems caused by the person, prevent the waste of medicine due to miscalculations due to drug doses, and prevent the damage caused by the wrong medical treatment applied to the patient.

6. Clinical Uses of Artificial Intelligence

- *Public Health Process:* Artificial intelligence applications can be used in subjects such as the application and evaluation of screening tests by reaching a large number of target audiences. Due to the COVID-19 epidemic, artificial intelligence applications are preferred today to protect people from risky areas and to predict their current health status without going to the hospital. During the COVID-19 epidemic, the data in the area where the application was made with the Filiation and Isolation Shading System (FITAS) were instantly lost to the system and used for rapid analysis. The spread plan for the first COVID-19 outbreak in Turkey was prepared. With the measures taken in line with the data obtained with FİTAS, it is aimed to reduce the rate of increase in the number of patients. [38].
- *Early diagnosis and emergency intervention process:* Especially in cancer cases, early diagnosis and treatment are very important. It is lifesaving to diagnose the complaint at the initial stage, without the need for visible symptoms. Parkinson's is a disease for which early diagnosis is important. In a prepared study, EEG (Electro moment cephalogram) signals, picture simulations, PDC (Partially directed coherence) data were categorized as sick people, drug addicts, and healthy individuals using machine learning skills. In the tests in the study, 99% of the real data were determined [39]. One of the generally known artificial intelligence support systems in the world is IBM Watson. With machine development and natural language processing capabilities, this system is designed to assist physicians in reviewing patients' electronic health records and reviewing search-related medical discovery publications and guidelines.
- *Interpretation of radiology images:* It is a very long process for the detailed viewing, interpretation, reporting, and evaluation of the report by the patient's physician. By choosing artificial intelligence applications, transferring images of physicians in patients with different nodules-lesions in radiology images can save both time and workload. In this way, a quality health service can be delivered in order to give the patient a timely opinion. In a study on the use of artificial intelligence applications in the field of radiology, Convolutional Neural Networks (ESA) were used for bone age estimation. As a result of the study, age evaluations of pediatric hand radiographs with ESA, evaluations of radiologists, and results were similar to the evaluations of radiologists [40].
- *The results:* It is extremely important to follow up the disease due to factors such as the recurrence of many diseases or the cause of another disease. By dressing the patient with artificial intelligence-based mobile devices, the patient can be followed by the physician wherever they are in the world. Since the test results given by the patient are recorded in the automation with the patient's permission, the physician can access and interpret the patient's results without reserving a place and time.
- *Treatment:* Clinical support systems primarily focus on complaint-oriented treatment algorithms, taking into account the symptoms and demographic information of the patients. The system has been used to identify bacteria that cause important infections and for antibiotics that can treat these infections [41]. In surgical operations, which is one of the treatment forms of patients, robots are used because of their benefits such as eliminating three-dimensional imaging vibration, facilitating access to organs, tissues, and nerves, and providing an ergonomic position to the surgeon. [42]. Together with the developments in artificial intelligence, the world's first and only robotic surgery system, the "Cyber Knife" has been developed. This robotic system performs the treatment with high-cure radiation, by looking at the tumor from different angles,

without the need for open surgery, without bleeding and pain, with an intervention that does not harm healthy tissues and cells [43].

- *Treatment process:* It provides support to the physician by predicting with artificial intelligence-based systems what kind of benefit and harm will be provided to the patient in the formation of possible treatment protocols or which protocol is preferred. The treatments of breast cancer patients by oncologists at a cancer center in India were compared in a retrospective observational study, using artificial intelligence applications called "Watson for Oncology". In general, the system showed a similarity of 93% (80% - 97%) according to cancer stage and age [44]. In another study, data on congenital cataracts were obtained from many hospitals. With the artificial intelligence-based system, it was determined that the framework showed 98.25% accuracy in the identification network and 92.86% accuracy in the treatment recommendations [45]. Different uses occur in artificial intelligence ophthalmology that can serve the purpose of providing excellent care [46].
- *Personalized treatment process:* Traditional treatment methods are insufficient to treat some diseases. Due to differences such as hereditary structure, immune system, and lifestyles, personalized treatment modalities need to be developed. Artificial intelligence applications are used in the development of personalized treatment methods. In a study conducted in Korea using the Technology Acceptance Model (TAM), a robot that provides home care services is recommended by taking into account parameters such as patients' behaviors, what they like, the number of people they live with, and their lives. In this study, 403 patients and their families were examined based on information. In particular, the robot's unique behavior and ease of use have been the most liked by the users [47].
- *Post- Treatment clinical decision process:* It contributes to the physician who has complications after the treatment and whether to continue the treatment.
- *Artificial intelligence-based robotic surgery process:* In our age, some complex hospitals have started to prefer artificial intelligence applications. Physician-assisted artificial intelligence-assisted surgeries are performed anywhere in the world at any time, regardless of place and time. Robots are also used as assistant surgeons in surgery. The Da Vinci Surgical System (The Da Vinci Surgical System) is one of the most commonly used robotic surgery systems [48].
- *Process of interpretation of pathology results:* It is preferred to reduce the presence of very rare cell images, errors caused by staining, and errors caused by wear and tear of the pathologist. Sepsis is a disease with high mortality, and it is a very difficult process to find and detect the relevant pathogen in patients. In an organized study, a classifier model was created with different machine learning methods using a database containing clinical metabolic sepsis patients. Using data from 100 patients in the database, 29 clinical and metabolic feature panels were analyzed. The result reached is the best AUC value (Area Under Cure) of 0.94. According to the results obtained, it was determined that the selected panel could be important biomarkers in distinguishing patients with sepsis [49].
- *Drug treatment and follow-up process:* It is very important for patients to take their drugs in the right cycle, at the right time, and with the right system. Artificial intelligence applications are used in the follow-up of drugs for chronic diseases such as Alzheimer's. By using face recognition technology and artificial intelligence-based systems, the patient's face is recognized, and it is determined whether the drug that the patient wants to take is correct. With the developing technology, it offers new styles for remote monitoring of Parkinson's disease. In a published study, motor nerve behavior was monitored for 6 months by looking at the way and duration of pressing the keys with a developed device. The patient's conditions were classified

with a new deep learning algorithm developed on the result. This study is an example of the use of unattended motor nerve data for drug response and monitoring [50].

- *Drug development process:* It includes valuable, time-consuming, and labor-intensive processes. Support is provided for drug development studies at the molecular level by using artificial intelligence technologies. For example, substances such as many drugs and nutritional supplements can cause oxidative damage to human cell factors. A quantum computer is needed to interpret the results using hydrogen atom transfer to predict the damage that these model materials can cause. A model using machine learning is proposed to assume and predict this effect. Thus, hardware and time costs are significantly optimized for this calculation [51].
- *Diagnosis of diseases:* Information from the Watson Health Platform, the guide, its applications, medical journals and textbooks, and the information in the patient's medical record are taken into account [52]. Moreover, it is possible to detect and mark lesion structures in "Aidoc" imaging results and report them in imaging results in [53]. The "Alive-Cor" deep learning system integrated into the smartwatch is a system that displays rhythm changes based on physical effort and reveals the risk of atrial fibrillation [54]. In addition, the "ResApp Health" application is used to measure various lung conditions such as chronic obstructive pulmonary disease, pneumonia, and chronic asthma [55]. The system uses the phone microphone to predict the breath of the entity. In addition to these applications, Laura, one of the nurse robots, can monitor the hospital's sepsis protocol and early vision through a computer program.
- *Evaluation of patients:* Artificial intelligence-based applications continuously monitor patients' vital signs such as blood pressure, respiratory rate, achromatism, and heart rate monitor. It can cover and send signals in case of emergency [56]. Pre-warning systems based on changes in patient's vital signs in emergency departments and around hospitals such as intensive care units facilitate the recognition of emerging symptoms and the discovery of extremities such as myocardial infarction, arrest, and sepsis, thus increasing the survival rate. Moreover, individualities can be followed in terms of health with applications that are used on mobile devices. Diabetes, eating habits, glucose levels, and effects status of the patients are also followed in the home situation. With these mobile applications, individuals can track themselves in terms of indicators such as step-taking tracking, heart rhythm measurement, and thnumbernt of calories lost per day, and reduce the risk of side effects thanks to early warnings. In the COVID-19 pandemic, artificial intelligence technologies have started to come to the fore more. Artificial intelligence has potential benefits such as early diagnosis, monitoring disease spread, tracking contacts, identifying people at risk, and making projections for the future [57]. In addition, the use of artificial intelligence in determining the virus structure and in drug and vaccine studies can have significant effects on epidemic management. Google published the COVID-19 Community Mobility Report for Turkey on April 5, 2020, which it obtained with a very simple artificial intelligence application [58]. In this report, in line with the epidemic measures, it was determined that mobility at public transport stops decreased by 75% compared to the pre-epidemic period, 60% in parks, 50% in workplaces, and 40% in markets. By developing such a system throughout the country, it will be possible to monitor how much social distance measures are followed during the epidemic period. It is known that systems that monitor the movements, contacts, and disease risks of individuals are used by developing much more detailed artificial intelligence applications during the current COVID-19 epidemic period in China [59]. In the project, individuals were given green, yellow, and red health codes based on big data and mobile internet technologies. While the colors represent their health status, travel history, and whether they have come into contact with people in the epidemic areas, as a

result of the findings, those with red or yellow codes were quarantined for 14 days. Another recently developed application, the COVID-19 Open Research Dataset (CORD-19), contains scientific articles on coronavirus research and is designed to facilitate the development of data mining and information retrieval systems [60]. The application helps scientists to access scientific data quickly. In addition, the World Health Organization has published an information retrieval system developed with artificial intelligence over Whatsapp and Facebook, which enables information about COVID-19 to reach more than 2 billion people [61]. There are studies on various methods based on machine learning for the diagnosis of the virus. Gozes et al. developed an artificial intelligence-based automatic image analysis tool on thorax CT images for the detection and tracking of the virus and reported that the application has a very high success rate [62]. Wang et al. It develops deep learning-based comprehensive tools to determine the respiratory patterns of people through camera images and to help diagnose the disease with the detected patterns [63]. It is also aimed that the developed tools can be used in the detection of COVID-19 on a large scale. Obtaining real-time data is extremely important for artificial intelligence studies and at the same time, it is very difficult to provide this data [64]. Consolidating worldwide patient data and creating accessible databases will make a strong contribution to the current pandemic as well as future outbreaks.

- *Patient home care process:* With the increase in the average life expectancy, the number of people with chronic diseases such as Alzheimer's and Parkinson's is increasing day by day. In addition, the number of older people living alone at home is insignificant. As an example, in 2018, health screenings for 68,400 patients related to the home care process in Finland were carried out in the virtual environment without leaving the house [65].
- *Nursing:* It is very important to collect data, determine appropriate diagnoses, and use technology at all stages of the planning process [66]. The use of robots in nursing was first created with the skeletal systems of laborious processes [67], then robots that connect the patient to a specialist, and assistive robots that carry the necessary equipment for patient care to nurses and store the equipment have been developed [67].
- *Future Trends:* A project named “Human Brain Project” was established in the European Union in 2013, aiming to investigate the differences in the mechanism, structure, and disease of the human brain [68]. The "Starlink Satellite Network" project was initiated by Elon Musk in 2015 to provide fiber-speed internet access, and the "Neuralink Project" became the agenda in 2017, right after. With these two projects, it is planned that the human brain will be subject to subjection and that the human brain will be able to access the internet through software. In addition, in the Neuralink project, it is stated that the neuron conditioning of the mechanism in the human brain can be recorded, and conditions such as "Alzheimer's, Dementia, Parkinson's" can be treated with wireless computer intermediate programs to be placed in the human brain [69].

7. Big Data and Artificial Intelligence Applications

- *Google Deepmind:* The Google Deepmind health project, initiated by Google within the scope of AI research, uses medical records to provide faster and better healthcare. Google Deepmind ensures that the information uploaded to the system is processed within minutes. Although research is currently in its early stages, Google is collaborating with institutions such as Moorfields Hospital and the NHS to develop the system [70].

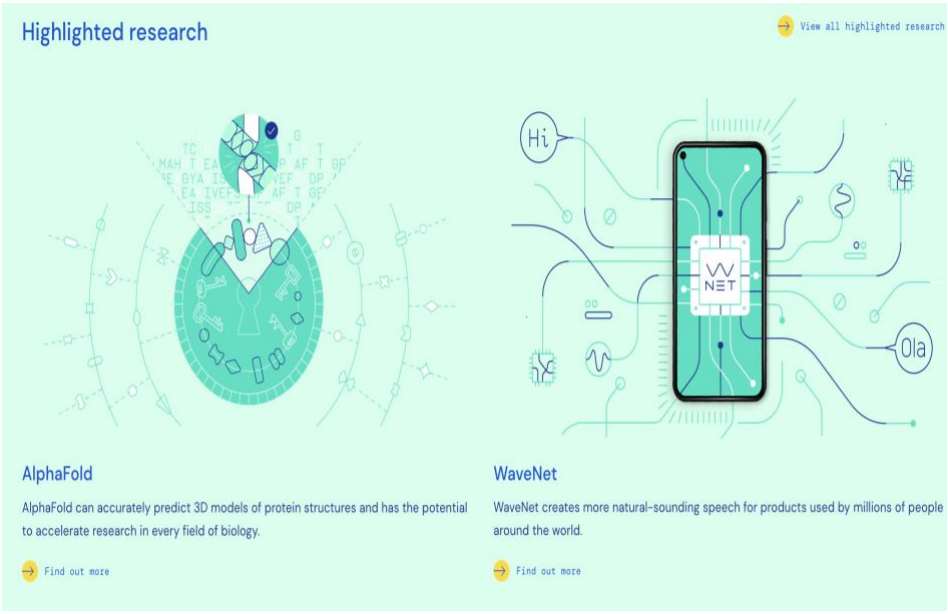

Figure 1. Google Deepmind artificial intelligence page

- *IBM Watsonpaths:* IBM Watson has started an in-house project called WatsonPaths in collaboration with Cleveland Clinic and Lerner Case Western Reserve University School of Medicine. WatsonPaths is designed to help physicians make more informed, more accurate, and faster decisions and to analyze electronic medical records (Electronic Medical Records), based on the Watson AI algorithm; It is a project run by IBM [71].

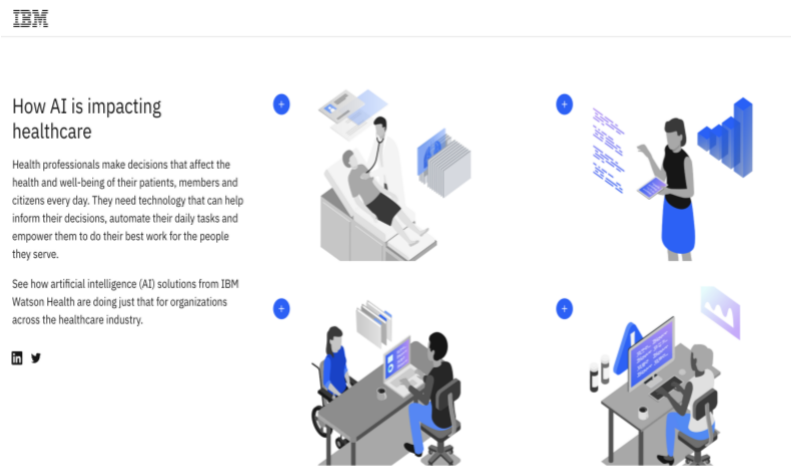

Figure 2. IBM Watsonpaths artificial intelligence page

- *CareSkore:* CareSkore is a Chicago-based platform that provides cloud-based AI solutions for the entire healthcare industry. CareSkore is an artificial intelligence system that basically uses the real-time Zeus algorithm and makes predictions by using the clinical, laboratory, demographic, and behavioral data of the patients as a source. In light of the data it collects, it aims to enable patients to obtain more transparent information about their own health and to increase the service quality of hospitals. In addition, patients can get detailed information about the risks and problems related to AI (artificial intelligence) in their own bodies by registering with this system individually [72].

Figure 3. CareSkore artificial intelligence page

- *Zephyr medicine:* The systems developed by William King Zephyr, who works at Johnson & Johnson, in order to better analyze various data for doctors, which were released to the market in 2011, work on algorithms that will reduce the time required for doctors to choose the right treatment. The project was selected as the first in the field of "Life Sciences" within the scope of "100 Most Inspiring Projects of 2016" by the readers of PharmaVOICE magazine. One of the biggest advantages of this system, which can process a data set very quickly with machine learning algorithms, is that it allows the visualization of big data [73].

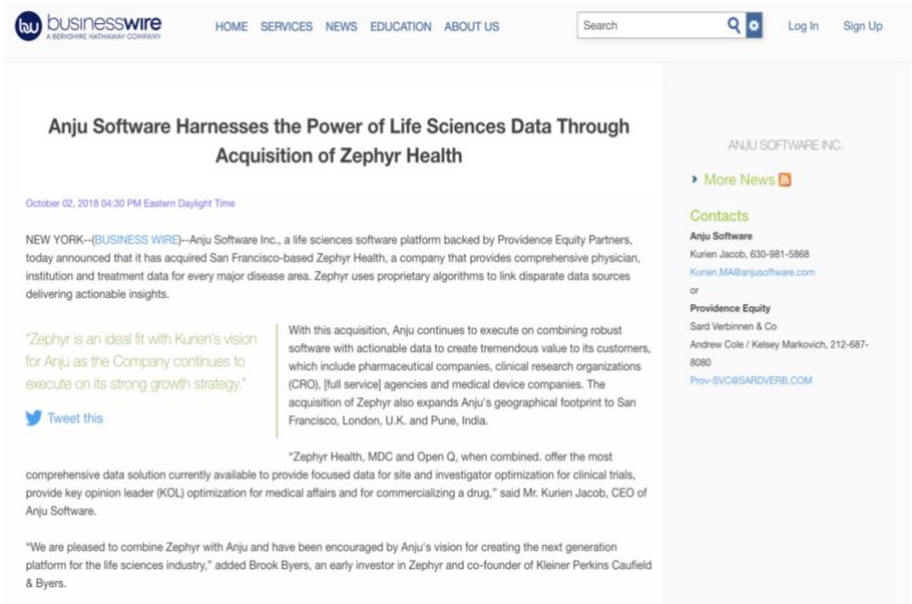

Figure 4. Zephyr Medicine's artificial intelligence page

- *Oncora medicine:* This Philadelphia-based start-up study aims to provide support in cancer research and treatment, especially in the field of radiotherapy. Radiation oncologist David Lindsay, one of the founding partners, created a digital database by organizing the electronic medical records he collected and wanted to design a platform that assists doctors in data analysis and radiotherapy treatment plans. In 2017, three major health centers and their 10,000 patients used the "Radiation Oncology" platform he designed to get help with personalized treatment [74].

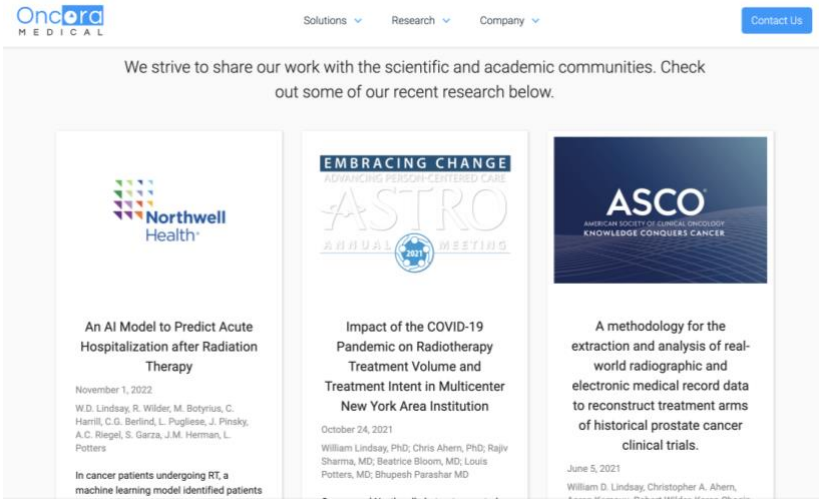

Figure 5. Oncora Medicine artificial intelligence page

8. Artificial Intelligence Applications in Medical Imaging

Medical imaging systems generally include methods for imaging the internal structures of the body. Devices such as X-Ray (X-Ray), MRI, Ultrasonography, and Computed Tomography are just a few of the commonly known ones. What comes to mind first when you think about these imaging techniques? Expensive and complex machines, sometimes even larger than a room. Currently, the biggest reason why these medical imaging technologies cannot become widespread is the expense of the devices and the need for qualified manpower for their use. These problems are exactly what AI start-ups are trying to solve. Although medical imaging systems are widespread in our country, 60% of the world still cannot reach modern medical imaging systems.

- *Enlitic:* It uses the power of image recognition to collect and analyze data, especially in radiographic images, thanks to deep learning technologies. Enlitic's AI interprets medical images in milliseconds, which is roughly 10,000 times faster than the average radiologist's performance in medical image interpretation. In addition, despite the simultaneous reporting of three radiologists in one test, the Enlitic system performed 50% more accurately and faster in classifying malignant tumors [75].

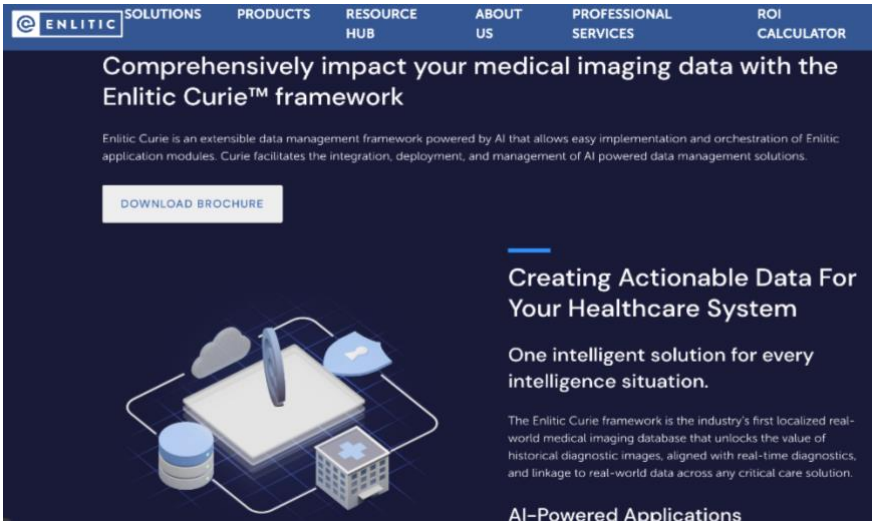

Figure 6. Enlitic artificial intelligence page

- *Butterfly Network:* The start-up, founded by Jonathan Rothberg in 2011, aims with the Butterfly Network to create a new medical imaging device that is significantly inexpensive and efficient from MRI and ultrasound. The ultimate goal of the start-up is to automate the medical imaging process [76].
- *Butterfly Network:* It uses the power of image recognition to collect and analyze data, especially in radiographic images, thanks to deep learning technologies. Enlitic's AI interprets medical images in milliseconds, which is roughly 10,000 times faster than the average radiologist's performance in medical image interpretation. In addition, despite the simultaneous reporting of three radiologists in one test, the Enlitic system performed 50% more accurate and faster in classifying malignant tumors [75].

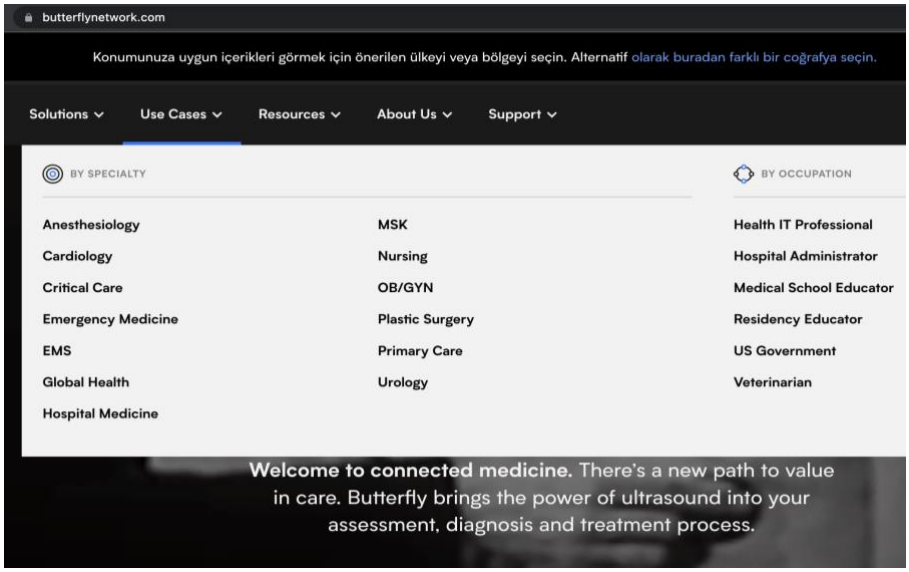

Figure 7. Enlitic artificial intelligence page

- *Lunit:* Founded in 2013, Seoul-based Lunit is the first software company to perform real-time artificial intelligence-based imaging analysis on the Internet. They aim to better model the morphology of lesions, to detect breast cancer early, and to help pathologists or researchers objectively determine the number of lymphocytes infiltrating tumors by examining chest X-ray, mammography, and pathology preparations with their artificial intelligence-based software [77].

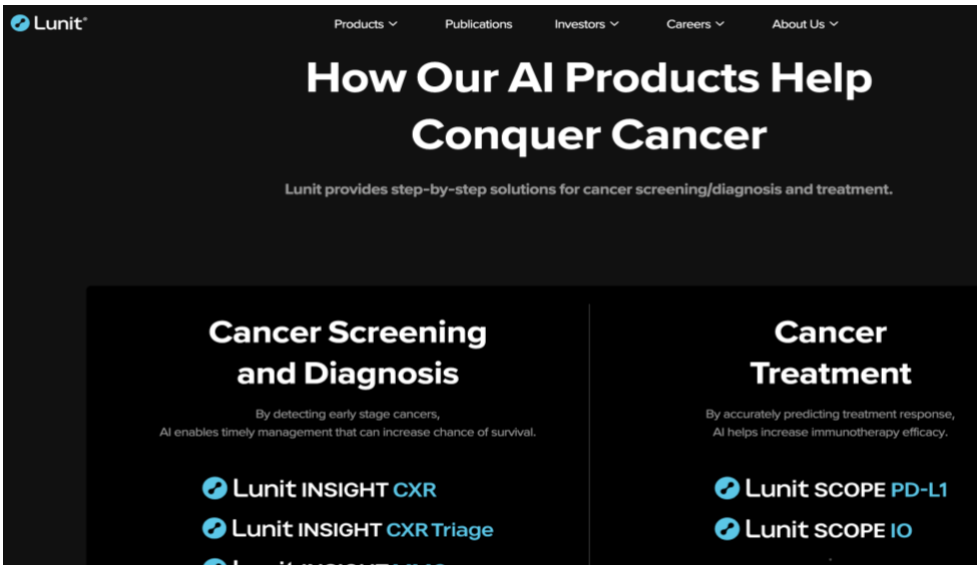

Figure 8. Lunit artificial intelligence page

- *Arterys:* The meeting of cloud, artificial intelligence, and medical imaging. This trio is the focal point of Arterys. The pioneering startup's goal is to "open the cloud power to medical imaging." In this new method developed jointly with GE Healthcare, Cardiac MRI scanning takes 6-10 minutes instead of 1 hour, and the patient does not have to hold their breath during the acquisition. The recordings are designed to be processed on Arterys' platform to obtain many additional data, including 3D heart anatomy, blood flow velocity, and blood flow direction [78].

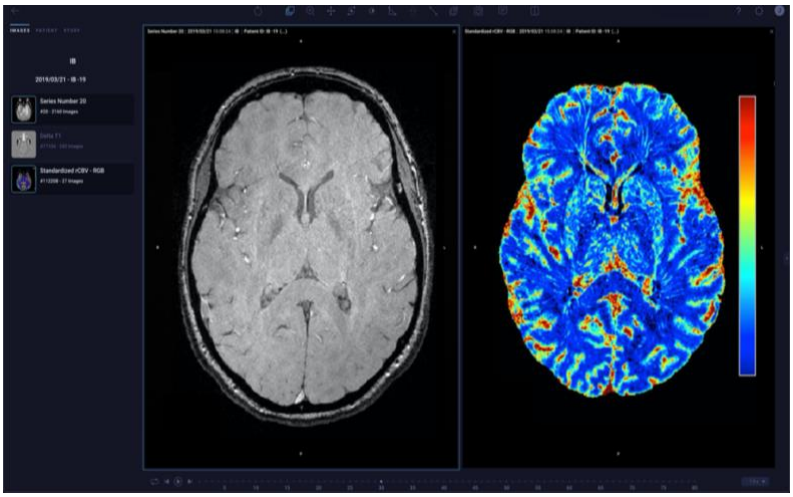

Figure 9. Arterys artificial intelligence page

- *Captain Health:* Bay Labs Inc is designed to assist healthcare professionals in the reporting of ultrasound images during the diagnosis and treatment of heart disease. In 2016, Bay Labs was established to assist in the early diagnosis of Rheumatic heart disease (RHD) in Kenyan school children was established. With this artificial intelligence system, radiologists screened 1200 children in 4 days and managed to diagnose 48 children with RHD and congenital heart disease [79].

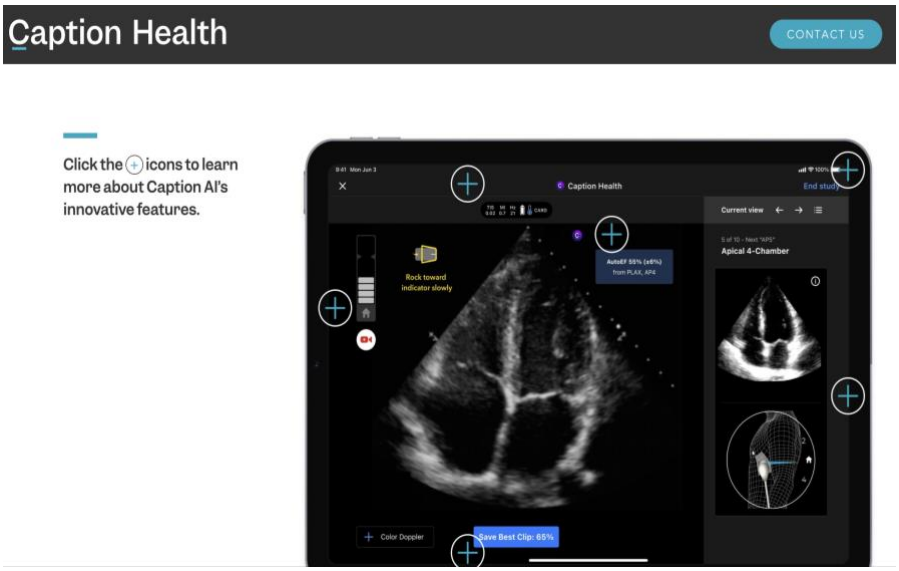

Figure 10. Caption Health artificial intelligence page

Artificial intelligence is widely used in the healthcare field. This technology, which works especially with large data sets, can be used in many areas in the field of health. For example, using artificial intelligence, diseases can be diagnosed, treatment options can be evaluated, and even the effectiveness of drugs can be predicted. Artificial intelligence can also be used in tasks such as data processing and reporting in healthcare systems. Many studies have proven the effectiveness of artificial intelligence in the field of health. For example, in one study, surgical interventions could be made more effective by estimating the size of cancer tumors using artificial intelligence. In another study, it was possible to predict the risk of having a heart attack again in patients who had a heart attack using artificial intelligence.

These examples show that artificial intelligence can be used effectively in the field of health. In the future, the use of this technology in the healthcare field will increase further, and more artificial intelligence applications will be seen in healthcare systems.

9. Benefits and Damages of Al Applications in HealthCare Management

Some of the benefits of artificial intelligence applications can be listed as follows:

1. If the inputs from the physicians are developed in a coordinated manner and the inputs and outputs are explained appropriately, standardization can be determined in the characterization of the disorder, detection, and reporting of the disease, thanks to artificial intelligence.
2. Since there are no continuous studies, it is possible to try to develop solutions to the problems. By combining many algorithms, a better algorithm can be produced (Integration Management) and new solution proposals can be presented.

3. It provides a gain in qualitative and quantitative data groups. For example, interpretation of test results and diagnosis of cancer may be preferred.
4. Different information can be accessed by using data obtained from other examination areas (Radiology, Pathology, Biochemistry, etc.). This information can be used in the diagnosis of different disorders by transforming it into meaningful information by choosing artificial intelligence technologies.
5. Time can be saved.
6. It can make tasks more doable by automating labor-intensive, time-consuming, and costly tasks.
7. Workload can be reduced [80].

When eye field scanning is performed by choosing artificial intelligence technologies, patients who will apply to the physician are pre-filtered. In this way, people who are not sick are prevented from applying to health institutions, while helping those diagnosed with the disease to be directed to the doctor in a faster time. This situation can indirectly play a very important and effective role in both calculating health costs and minimizing costs.

10. Artificial Intelligence Damages In Health Services Management

Some of the harms of artificial intelligence applications can be listed as follows:

1. Problems that may occur due to the fact that the people who shape the algorithm do not have the necessary medical knowledge and equipment, the work schedule of the radiologist is not understood, and the radiologist who will manage the algorithm due to this situation does not have knowledge of the subject, may cause problems due to incorrect use and interpretation. For this reason, multidisciplinary teamwork should be established. In the training process of radiological images, especially the radiologist should follow the images.
2. Accurate and necessary amounts of data sets are needed for image interpretation. It takes a certain amount of time for the data sets to come together, and the processes of checking the authenticity of the data sets are also very laborious.
3. If the data set does not provide enough samples, it may give misleading results.
4. There are no real examples in clinical drug therapy courses
5. It causes a great workload as a large number of images need to be converted to digital images in order to be archived.
6. With the development of technology, more important models based on artificial intelligence should be developed.
7. Necessary measures should be taken for the inadequacy of materials and equipment required for the establishment of the system and financial impossibilities [80].

Necessary measures should be taken for the inadequacy of the materials and equipment required for the establishment of the system and the financial impossibilities.

11. Artificial Intelligence Implementation Process In Turkey

In Turkey, the “National Artificial Intelligence Strategy Preliminary Report” was prepared by “Artificial Intelligence Research Initiative and Door Technology” in 2017 [80]. “Presidential Digital Transformation Office” was opened in 2018 [81]. Artificial intelligence algorithms and clinical decision in Turkey support systems were first able to detect abnormal structures in the brain with an MR imaging device within the scope of the “Turkish Brain Project” in partnership with the digital transformation office and Gazi University, and the reporting process was carried out without the need for a radiologist who performed this process [82]. In 2019, "Turkey Health Data Research and Artificial Intelligence Institute" was established under the Presidency of Turkish Health Institutes. In Turkey, studies on

portable applications have begun to be carried out in order to provide follow-up and operation management in areas such as diabetes, allergy, asthma, and mental health [83]. In addition to these, a program used in the long-term care of chronic diseases and in the follow-up of drugs, diets, and exercises has been created by the Compack company with the "TeleHealth Project". This program can provide follow-up of patients at home after accidents and surgery and support their relatives in the care process [84].

12. Discussion and Conclusion

AI in healthcare is a broad term used to describe machine learning algorithms, software, or artificial intelligence to mimic human cognition in the analysis of complex medical and healthcare data. Recent developments in artificial intelligence are hopeful and exciting in the field of Health as well as in all fields. It is inevitable for the health sector to follow the developments in many sectors in the field of artificial intelligence. However, it should not be expected to progress as fast as in other sectors in a subject such as human health, where it is unacceptable to make mistakes. To get the most out of technology, one must be patient and act cautiously. Developed applications should be evaluated with appropriate scientific studies, and progress should be made in a rational framework based on evidence.

The primary purpose of health-related AI applications is to analyze the relationships between disease prevention or treatment techniques and patient outcomes. Artificial intelligence programs are applied for applications such as diagnosis processes, treatment protocol, and drug development, personalized medicine, patient monitoring, and care. AI algorithms can also be used to analyze large amounts of data through electronic health records for disease prevention and diagnosis. Big technology companies such as IBM and Google have also developed algorithms for healthcare. In addition, hospitals need AI software to reduce costs, increase patient satisfaction, meet staff and workforce needs, and support initiatives. Currently, the United States is investing billions of dollars to advance the development of artificial intelligence in healthcare. Companies are optimizing staffing levels by reducing the number of inpatients and length of stay. In this way, technologies are developed to help health managers improve their work.

As a result, institutions and qualified personnel are needed to evaluate the short and long-term effects of AI. Developers should consider the adoption of appropriate technologies, as well as the assessment and monitoring of security, accountability, and transparency mechanisms. It should be aimed that developing technologies do not increase inequalities in health and that all segments of society can benefit from these services. As with scientific developments, technological developments should also be used to improve health.

Ethical Statement

This paper is exempt from the Institutional Ethics Committee review since it does not involve human subjects.

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Conflicts of Interest

There is no conflict of interest to declare.

Authors Contribution

The article was prepared by one author.

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