Clinical and Experimental Health Sciences

Effect of Digitalization on Nursing Practices Using the Lean Approach

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ABSTRACT

Objective: This study aimed to examine the effect of digitalization on nursing practices using the lean approach.

Methods: This is a descriptive observational study. The data were collected using an activity chart to record nurses' direct and indirect care practices and personal work and the Value Stream Map to compare and analyze work processes and determine both waste and value areas in the clinics. The study included a total of 15 nurses from two different internal medicine units of a hospital, including one digital clinic that uses digital applications for nurse work processes, and one partial digital clinic that has limited digital applications. The data were analyzed using current state value stream mapping, lean seven waste areas, and future state value stream mapping.

Results: In the digital clinic, 748.5 minutes were allocated for direct care, 129.1 minutes for indirect care, and 562.1 minutes for personal work. Total value-added time and non-value-added time was calculated as 1137.1 and 302.9 minutes, respectively. In the partial digital clinic, 623.9 minutes were allocated for direct care, 404.4 minutes for indirect care, and 411.1 minutes for personal work. Total value-added time and non-value-added time was calculated as 1006 and 433.4 minutes, respectively. According to the future state value stream map prepared in line with the improvement suggestions to eliminate unnecessary production, process, movement, transportation, waiting, and error waste in the current state of both clinics, it is predicted that 1354.3 minutes of value-added time will be obtained and non-value-added time will decrease to 85.7 minutes, by spending 910.9 minutes less on direct care, 190.2 minutes less on indirect care, and 259.2 minutes less on personal work.

Conclusion: The lean approach creates a repeated opportunity to review and improve processes. Analyzing nursing processes using the lean approach before and after digitalization and reviewing sources of both waste and value will contribute to implementing higher quality nursing care practices more effectively and safely and to using time and staff more efficiently.

Keywords: Digitalization, lean approach, nursing care, nursing practices.

1. INTRODUCTION

In the field of health, digitalization is defined as medical applications provided through different digital technologies to support and improve the delivery and management of health care services (1). Digitalization changes health service delivery routines to a great extent (2). Nurses constitute the largest workforce in health service delivery and have an important role in achieving quality care outcomes (3). Digitalization is used in nursing practices to increase both the quality and efficiency of care and time and cost efficacy in direct and indirect care environments such as electronic health records, bedside technologies, and drug applications (4–7). Since digitalization affects and changes the way nurses work, it is necessary to determine how nurses coordinate their workflows. Here, the critical question is to what extent digitalization contributes to patient care and how to use the time saved (8). Value and waste management are significant in radical change processes such as digitalization. The lean approach is a well-planned methodology for organizing processes and systems in such radical changes (9) and is based on the Toyota Production System. Despite its industrial origins, the philosophy of the lean approach has also encompassed healthcare (10). The lean approach focuses on eliminating waste and generating value. In the healthcare system, this means providing lean healthcare that respects and meets patient needs and preferences (11). In lean healthcare, a value is produced for patients as customers. Patient and nurse journeys are inextricably linked. In the processes analyzed, planned, and managed

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with a lean approach, the aim is to increase the time nurses spend at patients' bedsides, that is, to direct care practices, to improve patient outcomes, increase patient safety, and make patient care higher quality and more efficient (3,9,12).

Studies about the relationship between digitalization and nurse work have used observational approaches in terms of time and movement and examine processes retrospectively or prospectively. Although preferred in health services, the design, execution, and reporting of the results of movement studies are generally inadequate (6). The lean approach can be used to evaluate how effectively and efficiently digital processes are managed, whether they produce value in services, or what kinds of waste they cause (13). There are no studies about the digitalized nursing practices that compare business processes with non-digital processes in terms of time and patient safety using the lean approach and re-examine digital processes in terms of waste and value.

This study was conducted to determine and compare the sources of waste and value in two clinics, one with digital systems and one without digital systems, in nursing practices and to examine the effects of nursing practices on time and patient safety in these clinics using the lean approach.

2. METHOD

2.1. Study Place and Features

The study was conducted in two different internal medicine clinics of a public hospital, which were comparable in terms of patient type and burden. In this hospital, nursing services are delivered in three different shifts: 8, 16, and 24 hours. One of the clinics is a digital clinic that actively uses digital hospital processes in direct and indirect patient care. The digital clinic (DC) has a 42-bed capacity with a 48% occupancy rate and employs 11 nurses. In the DC, a nurse cares for an average of 10.7 patients per shift. The other is a partial digital clinic with limited use of digital applications. The partial digital clinic (PDC) has a 22-bed capacity with a 90% occupancy rate and employs 10 nurses. In the PDC, a nurse cares for an average of 10.5 patients per shift.

2.1.1. Digital Clinical Work Processes

Radiology information management system (RIMS); refers to the use of all radiology processes in a digital environment that can be processed, archived, viewed, and converted into statistical data upon user authorization.

Laboratory information management system (LIMS); refers to the system used to make, conclude, approve, and report orders and convert them into statistical data in laboratory services in digital hospital structures.

Clinical decision support system (CDSS); is used to obtain information from available sources, which are used to analyze and make decisions according to a certain situation of the patient. It streamlines decision-making processes, prevents errors with an early warning system, and supports patient-centered care. CDSS contains both written and audio information about drug interactions or administration and is used during treatment practices in the DC.

Computerized physician order entry (CPOE); refers to the entry of computerized drug orders for patients in inpatient clinics by physicians. CPOE aims to increase patient, employee, and drug safety, quality, and value, and to eliminate illegible handwriting and inaccurate and incomplete order errors. It is used by physicians in the DC.

Closed-loop drug administration (CLMA); refers to a system that starts with introducing drugs into hospital stocks and is completed with their administration to patients, providing patient and drug safety with software and hardware technology. In this system, first, the physician creates an electronic medication order. Then the drugs are packaged under the control of pharmacists, in unit doses, on behalf of the patient and sent to the clinic. When the treatment time comes, the nurse places the drugs in the treatment trolley with a computer and barcode reader and goes to the patient's room. The nurse activates the digital system using her username and password. By scanning the patient's wristband with a barcode reader, the digital patient information card of that patient is opened. The drug is verified by reading the drug barcode at the time of treatment. When the drug is confirmed, the CDSS is activated, creating written, audio, and visual stimuli about the route of drug administration, drug dose, and drug/food interactions. After the drug is administered to the patient, the treatment time is recorded in the system. The CDSS promotes administering the right drug to the right patient, in the right dose, in the right way, and at the right time. Treatment trolleys with barcode readers and computers are used in the DC.

Nurse information system; refers to the digital systems used to record nursing practices. This system is used to record nurses' measurements and follow-up processes, vital sign data, treatments, and nursing care plans in a digital environment. It is used in all nursing processes in the DC.

In the DC, admission of patients to the clinic, anamnesis data taken at hospitalization, and discharge procedures are performed electronically. To make a nursing care plan, nurses use digital systems in data collection, diagnosis, planning, application, and evaluation steps. No paper documents are used in the DC, except for those that must contain wet-ink signatures due to legal obligations, such as consent/approval forms. At the end of their shifts, nurses write a report by signing and certifying a shift log.

2.1.2. Partial Digital Clinical Work Processes

In the PDC, the digital applications are RIMS, LIMS, and an e-order system without physician support. In this clinic, paper-based documentation systems are used in nursing processes. Nurses create a daily nurse observation form for each patient. This form includes the patient's identity information, measurement and follow-up procedures, vital signs, and daily treatment plan. In addition, paper patient files

are used during clinical admission, anamnesis, and discharge. In the treatment process, the physician informs the nurse about the daily treatment plan with a paper prescription. The nurse sends the drug orders to the pharmacy through the e-order system. The drugs come to the clinic in bulk. Nurses collectively prepare the drugs for patients in the treatment room and travel to the patient for drug administration. After they administered the drug, they first record it on the nurse observation form and then in the electronic environment. Nurses use both electronic and paper documents for data collection, diagnosis, planning, application, and evaluation steps of the nursing care planning process. At the end of their shifts, nurses write a report by signing and certifying a shift log.

2.2. Study Population and Sample

The study was conducted using a total of 15 nurses, seven from the DC and eight from the PDC, who agreed to participate in the study.

2.3. Data Collection Tools

Activity chart; was used to record the content of nursing practices and the time spent on these practices. It is composed of three parts: one for direct patient care, one for indirect patient care, and one for the time devoted to personal work.

Value stream map (VSM); refers to the diagrams of both material and information flows until the delivery of an order to the customer. Several terms are used to express process information while drawing a value stream map including cycle time (C/T), processing time (P/T), value-added time (VA), non-value-added time (NVA), and lead time (L/T). Value flow mapping consists of four steps: product family selection, current state VSM for current state analysis, future state VSM for the desired destination in the future, and planning-implementation (14).

3. RESULTS

Value stream mapping, a lean technique, was used in this study. Value stream mapping steps are given below.

Selection of product family: Considering nursing activities, the work shift from 08:00 am to 08:00 am was determined as the product family, since a 24-hour shift system includes all workflow processes and has a high representative power.

Determining the main processes: In this study, the main processes for DC and PDC during a 24-hour shift were determined as direct and indirect care practices and personal work. Due to the long duration of direct care practices in nursing care, their duration is desired to be low. However, the characteristics and care needs of patients in nursing services are different from each other. Therefore, the same operations may be completed at different times in care processes or all care practices may not be performed in the same shift.

Making observations: Direct and indirect care practices and personal work of each nurse, and their repetitions were recorded using an activity chart and a stopwatch with a reversible counter. When the observation started, the stopwatch was started, and when the process was finished, it was stopped and reset. The observations took 360 hours in total, 168 hours for the DC and 192 hours for the PDC. Observations were made between September and December 2018.

Determining the processes to be included in value stream maps: Similar nursing practices in the main processes are grouped and explained as follows.

Direct care practices

***Communication with the patient*;** The processes of communication with patients in both the DC and PDC include nursing care practices such as patient education and psychological support, and were observed 135 times in the DC and 121 times in the PDC.

Follow-ups and measurements; Follow-up and measurement processes in both the DC and PDC consist of monitoring such as blood glucose measurement, weight monitoring, or patient follow-up, and were observed 108 times in the DC and 111 times in the PDC.

Vital signs follow-up; Vital signs of patients in the DC are recorded in an electronic environment via tablet computers immediately after they are measured. However, the vital signs of patients in the PDC are measured and recorded on a nurse observation form at the desk. Vital sign follow-up procedures were observed 166 times in the DC and 177 times in the PDC. Figure 1 shows images of the vital signs follow-up process.

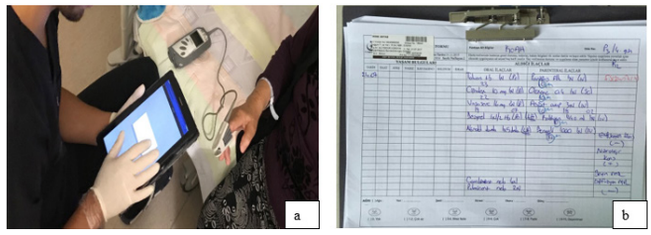

Figure 1. *Digital and partial digital clinical vital signs tracking records. a; digital clinical tablet, b; partial digital clinical nurse observation form.*

Interventional procedures; The interventional procedures in both the DC and PDC include vascular access and blood sampling, and were observed 76 times in the DC and 74 times in the PDC.

Treatment practices; Both CDSS and COPE-supported CLMA are used for treatment practices in the DC. In the PDC, the drugs prepared in the treatment room are administered collectively. Figure 2 shows treatment practices. Treatment practices were observed 16 times in the DC and 175 times in the PDC.

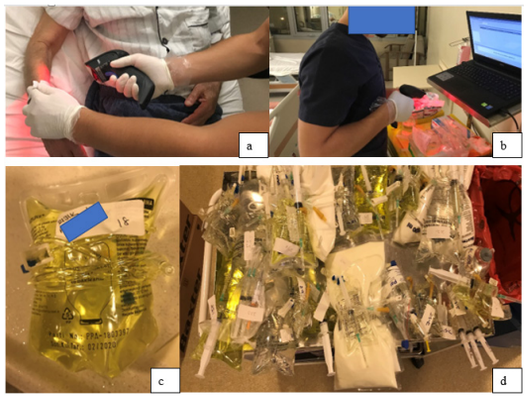

Figure 2. *Treatment practices*
a; verification of patient identity in the digital clinic, b; verification of unit dose of the drug by barcode reader in the digital clinic, c; patient's drugs in the partial digital clinic, d; collective treatment application in the partial digital clinic

Other direct care practices; Other direct care practices include processes such as feeding patients and changing dressings, and were observed 77 times in the DC and 104 times in the PDC.

Indirect care practices

Bedside visit; In the DC, bedside visits are made via a tablet computer. Nurses see all patient data, such as vital signs, follow-up and measurements, and treatment plan in the nurse information system. In the PDC, bedside visits are made through nurse observation forms and patient files. During the visit, nurses take all the files with them. Bedside visits were observed 76 times in the DC and 79 times in the PDC. Figure 3 shows the images of bedside visits.

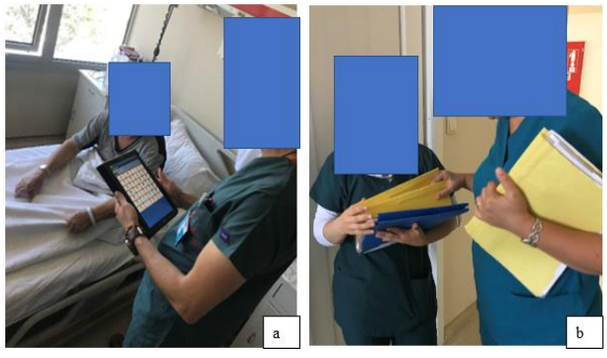

Figure 3. *Bedside visit*
a; digital clinical bedside visit, b; partial digital clinical bedside visit

Treatment preparation; In the DC, treatments are prepared and applied at patients' bedsides by CLMA systems. In the PDC, treatments are prepared collectively in the treatment room. Treatment preparations were observed 72 times in the PDC.

Communication with other persons; Communication with other persons in both the DC and PDC includes training for relatives, phone calls, and communication with other employees, and was observed 43 times in the DC and 56 times in the PDC.

Desk work; Desk work in both the DC and PDC includes nursing care planning processes, nutrition plan preparation, and consultation procedures. Several data such as blood glucose measurement, vital sign follow-up, anamnesis information, and laboratory results are used while planning nursing care for patients. All these data are accessible electronically in the DC, while nurses benefit from both digital systems and paper documents in the PDC. Desk work was observed 59 times in the DC and 73 times in the PDC.

Other work in the clinic; Other work in both the DC and PDC covers processes such as the supply of materials and devices and delivery of desk duties and was observed 36 times in the DC and 40 times in the PDC.

Paperwork; In the DC, no paperwork is used except for patient consent/approval forms, which must contain wet signatures, and a shift log. Paperwork was observed 21 times in the DC. In the PDC, a nurse observation form is prepared daily for each patient and patient files are used to record patient information. Paperwork was observed 120 times in the PDC.

Double entry; In the PDC, nurses make a nursing care plan and prepare the patient's medications both in the digital system and on the nurse observation form, making double entries. Double entries were observed 45 times in the – PDC.

Order transactions; In the PDC, nurses order medication via an e-order system. Order processes were observed 69 times in the PDC.

Personal work

Basic needs; Basic needs in both the DC and PDC covers nurses' needs such as dressing, eating, restroom, personal phone calls, and rest during 24-hour shifts. In the hospital where the study was conducted, nurses use two 20-minute meal breaks in 24-hour shifts and rest after midnight according to the suitability of their clinics. Basic needs were observed 36 times in the DC and 44 times in the PDC.

Non-productive time; Non-productive time in both the DC and PDC refers to the time when nurses wait without producing work and was observed 37 times in the DC and 24 times in the PDC.

Determining the symbols of the current state flow map: Several symbols were created to show nursing practices in the main processes on the map and are shown in Table 1.

Table 1. *Value stream map symbols*

Nurse	Communication with patient	Follow-ups and measurements	Vital sign follow-up
Interventional procedures	Treatment practices	Other direct care practices	Bedside visit
Treatment preparation	Communication with other people	Desk work	Other work in the clinic
Double entry	Paperwork	Order transactions	Basic needs
Non-productive time	Direct care	Indirect care	Personal work
Digital workflow	Workflow	Nurse flow	Time axis

Determining task times: A total of 1440 minutes was taken as a basis for determining usable times in the calculation of task time. The rates used in nurse work studies were used while calculating the daily demand. Accordingly, a nurse should allocate at least 60% of her shift time to direct care practices, 22% to indirect care practices, and 18% to personal work (15). For both clinics, task times were calculated as 864 minutes for direct care practices, 316.8 minutes for indirect care practices, and 259.2 minutes for personal work.

Determining system measurements: C/T was calculated by dividing the total time spent in nursing practices, to which the main processes are allocated, by the total number of observations. P/T was calculated by dividing the total time spent on nursing practices, to which the main processes are allocated, by the number of nurses. L/T was taken as 1440 minutes according to a 24-hour shift schedule. In addition, VA and NVA, which were determined by comparing task times in the DC and PDC processes, were used.

Drawing the current state VSM for digital and partial digital clinics:

The data obtained from observations were used to create current state VSMs to show nurses' workflows.

Figure 4 shows the current state VSM for the DC. Accordingly, in the DC, a total of 748.5 minutes were allocated to direct patient care, 129.1 minutes to indirect patient care, and 562.1 minutes to personal work. During the process, the total VA was calculated as 1137.1 minutes and the total NVA was 302.9 minutes.

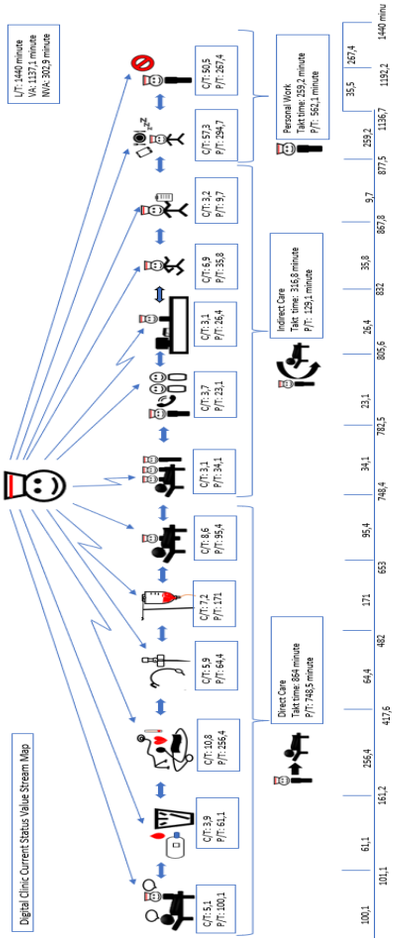

Figure 4. *Digital clinic current status value stream map*
C/T: cycle time, P/T: processing time, L/T: lead time. VA: value-added time, NVA: non-value-added time

Figure 5 shows the current state VSM for the PDC. Accordingly, in the PDC, a total of 623.9 minutes were allocated to direct patient care, 404.4 minutes to indirect patient care, and 411.1 minutes to personal work. During the process, the total VA was calculated as 1006 minutes and the total NVA was 433.4 minutes.

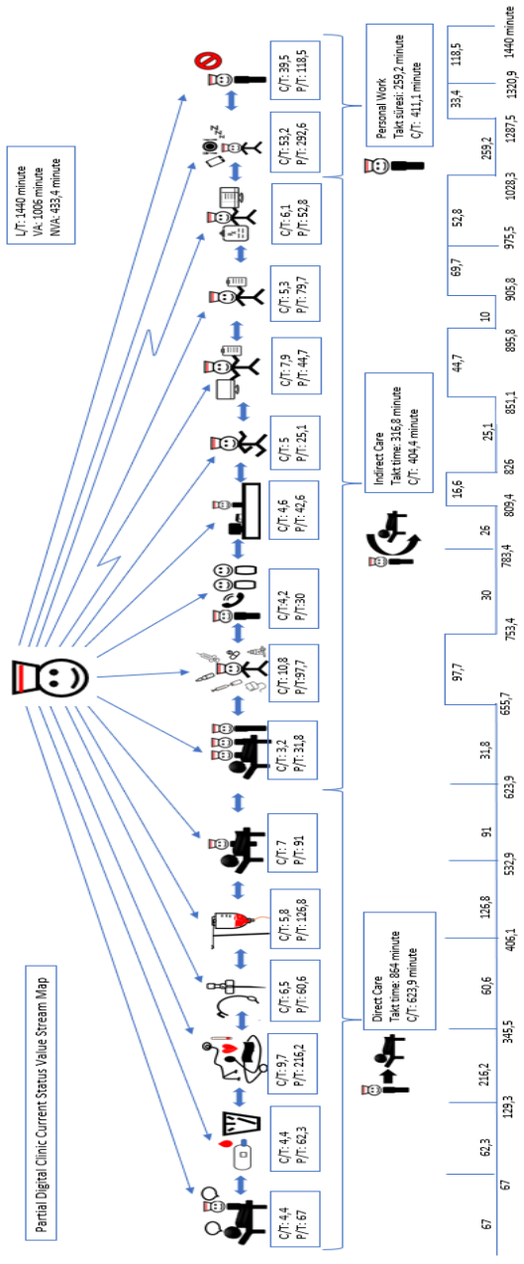

Figure 5. *Partial digital clinic current status value stream map C/T: cycle time, P/T: processing time, L/T: lead time. VA: value-added time, NVA: non-value-added time*

Determining waste areas and suggestions for improvement: As a result of the comparison of current states in both the DC and PDC, the transactions considered waste were determined according to seven waste types in the lean approach. Several suggestions are presented to eliminate the waste areas.

Direct care practices waste areas and improvement suggestions

Vital sign follow-up; According to their current state VSMs, a total of 256.4 minutes were allocated to vital sign follow-ups in the DC and 216.2 minutes in the PDC. In the DC, vital signs were measured and immediately recorded via tablet computers at patients' bedsides and then included in the direct care practice. In the PDC, vital signs were recorded on paper documents at the desk, increasing the time to perform indirect care practices. If tablet computers are used in the PDC, vital sign follow-ups can be recorded at patients' bedsides, increasing the time to implement direct care practices and eliminating paperwork.

Treatment practice; A total of 171 minutes were allocated to treatment practices in the DC and 126.8 minutes in the PDC. In the DC, treatments are administered by the CDSS-supported CLMA system, which keeps medication, drug dose, time, patient information, and route of administration closely regulated. In the PDC, treatments were applied collectively, causing unnecessary movement and transportation waste and leading to inadequate warning systems and error waste in drug safety. If treatment practices in the PDC are performed by the CDSS-supported CLMA system, the time spent by nurses on direct care practices will increase, preventing movement and transportation waste by administering drugs on a patient basis and ensuring drug safety.

Indirect care practices waste areas and improvement suggestions

Bedside visits; In the DC, bedside visits were made via tablet computers. In the PDC, nurses made bedside visits by taking all the patient's documents with them, causing unnecessary movement and transportation waste. If a tablet computer is used for bedside visits in the PDC, the transportation and movement of patient files can be prevented.

Treatment preparation; In the DC, drugs were prepared using the CDSS-supported CLMA system. In the PDC, nurses spent 97.7 minutes in the treatment room for drug preparation, causing unnecessary production and processing waste, inadequate warning systems, and error waste in drug safety. If treatment is prepared by the CDSS-supported CLMA systems in the PDC, a total of 97.7 minutes will be saved from indirect care practices, eliminating unnecessary production, process, and error waste.

Desk work; In the DC, only digital systems were used in nursing care planning and consultation processes. In the PDC, as these processes use both digital systems and paper-based documents, a total of 16.6 minutes was wasted, resulting in unnecessary processing waste. If paper-based documents are removed in the PDC, nurses will obtain all the data from digital systems, preventing the unnecessary waste of 16.6 minutes of processing.

Double recorded applications; In the PDC, nurses recorded nurse care plans and treatment practices using both paper documents and the digital system therefore spending 44.7 minutes on double entry processes, causing unnecessary production and process waste. If paper-based documents are removed in the PDC, the unnecessary production and process waste of 44.7 minutes will be prevented in the process.

Paperwork; In the PDC, a total of 69.7 minutes was allocated to prepare paper-based documents by nurses, causing unnecessary production and process waste. In addition, since all paper documents were handwritten, document standardization was considered an error waste. If paper-based documents are removed from nursing processes in the PDC, unnecessary production and process waste of 69.7 minutes spent on their preparation will be prevented, and the error waste can be prevented by ensuring document standardization.

Order transactions; In the PDC, nurses spent 52.8 minutes ordering written patient prescriptions by the e-order system, causing unnecessary production and process waste. By a transition to the CLMA system, the unnecessary production and process waste of 52.8 minutes will be prevented in the PDC.

Personal work waste areas and improvement suggestions

In both the DC and PDC, the time allocated to nurses' basic needs was excessive, whereby non-productive time leads to the wastage of waiting. Nurses in the DC spent 35.5 minutes more time than the estimated task time on basic needs, and their non-productive time was 267.4 minutes. In the PDC, nurses spent 33.4 minutes more time on basic needs and their non-productive time was 118.5 minutes. Considering the work processes of both clinics, it is suggested to move the PDC to the DC due to the high time allocated to personal work in the PDC and the low bed occupancy rate (48%) in the DC. Thus, the bed occupancy rate will increase, the time allocated by nurses to non-productive work will decrease, and the partial digital processes will be replaced by digital processes, eliminating 10 nursing positions in the PDC.

Future state mapping: A common future state VSM was drawn for both clinics. The future state VSM, shown in Figure 6, was drawn in line with the improvement suggestions to eliminate the waste types and resources determined according to both the DC and PDC current state VSMs. For the future state VSM, C/T was calculated by dividing the total observation times obtained from both clinics by the number of observations. P/T was calculated by dividing the total observation times by the total number of nurses in the DC (11 nurses: current number of nurses in the DC, as those in the PDC are recommended to be employed in the DC). According to the future state VSM drawn in line with the recommendations, it is predicted that 1354.3 minutes of VA will be obtained and NVA will decrease to 85.7 minutes, by spending 910.9 minutes less on direct care, 190.2 minutes less on indirect care, and 259.2 minutes less on personal work. Thus, unnecessary production, waiting, idle operations, movement, transportation, and error waste will be converted into value, eliminating 10 nursing positions in the PDC.

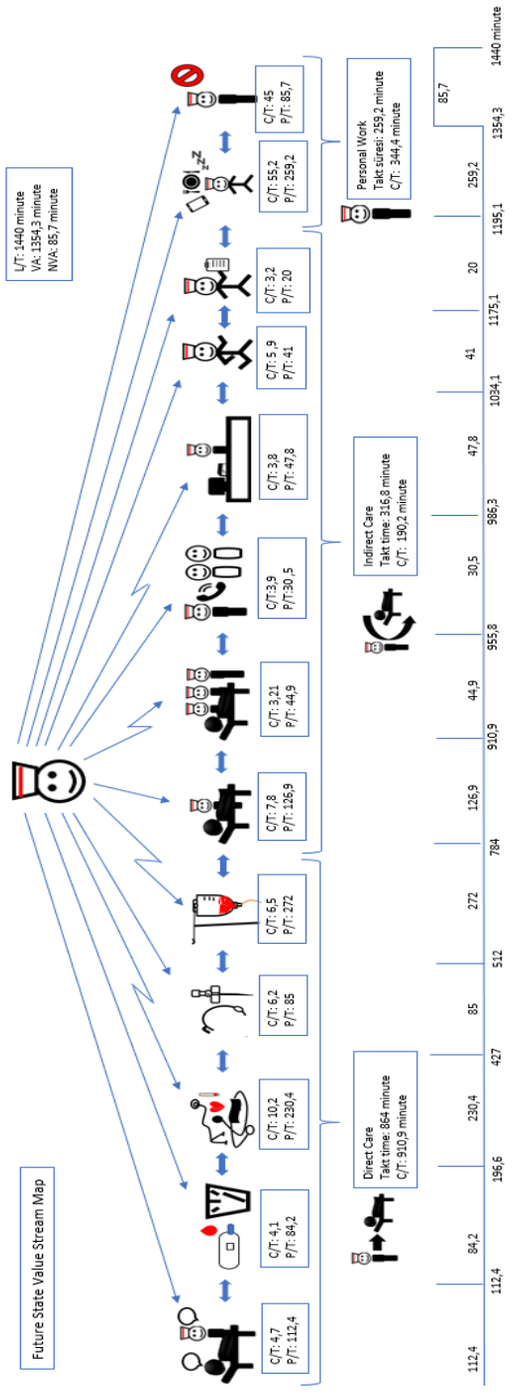

Figure 6. *Future state value stream map*
C/T: cycle time, P/T: processing time, L/T: lead time. VA: value-added time, NVA: non-value-added time

Evaluation: The process analysis for the future state was performed for both clinics, considering waste in its current state and presenting solution proposals to eliminate them. Table 2 shows the data of the processes. Thanks to our improvement suggestions, it is predicted that a non-digital clinic of the relevant institution will digitize its processes, allowing the clinics to serve at full capacity, increasing time added values in the processes, decreasing process waste, and thus saving a total of 10 nurses.

Table 2. *Analysis of digital and partial digital clinical processes*

	Direct care*	Indirect care*	Personal work*	VA	NVA
Digital clinic current state	748.4	129.1	562.1	1137.1	302.9
Partial digital clinical current state	623.9	372.6	411.1	1006	433.4
Future state	910.9	190.2	338.6	1354.3	85.7

**Time spent (MiWnute), VA: value-added time, NVA: non-value-added time*

4. DISCUSSION

This is the first study that analyzes digitalized nursing practices with lean methods, compares them with non-digital processes, determines the sources of waste and value, and establishes the desired future outcome by presenting relevant suggestions.

Our study has found that according to VSMs, more time is spent in direct care practices in DCs compared to PDCs, and this time added value to the processes in both clinics. Considering the current state of VSMs, these time differences in direct care practice work processes are caused by processes of communication with patients, vital sign follow-ups, and drug administration times. Tablet computers and CDSS-supported CLMA systems are used in vital sign follow-ups and drug applications in the DC. Using digital technologies such as CLMA significantly increased the time spent by nurses at the bedside, the communication and interaction between nurses and patients, and the time nurses spent preparing and administering ordered medications. In addition, a transition from paper-based patient records to digital applications can allow nurses to provide patient-centered, quality, and safe nursing care by securing records (6,16,17). In the future state, the use of digital systems in PDCs will increase the time allocated for direct patient care and prevent movement, transportation, and error waste.

Nursing work processes are often overloaded with NVA jobs that directly impede nursing care. Nurses work in waste-filled systems that keep them away from patients (18). This study determined that 129.1 minutes were spent on indirect care practices in the DC and 404.4 minutes in the PDC, according to their current state VSMs. All transactions add value to the process in the DC, while 281.5 minutes were spent on wasted areas in the PDC, due to drug preparation in the treatment room, preparation/use of paper-based documents, double entry of some transactions, nurses' data collection from both digital and paper systems, and additional entry of e-orders for drugs prescribed by physicians. Davies et al. (3) analyzed nurse processes by the lean approach and reported that nurses spent more time at the desk rather than bedside visits, made repetitive data entries, spent excessive time on drug preparation and orders, and therefore, allocated less time for direct patient care. Studies of digitalization processes show that digital systems save nurses' time, facilitate care processes, reduce the time allocated to desk work, prevent double entries by eliminating the use of both paper and digital systems, and reduce the time nurses spend preparing paper documents, medication prescriptions, and drug orders (19–22). In addition, digitalized applications improve nursing practices by allowing them to use a computerized doctor order entry system, have warning screens for confirming patient identity and drug names/appearance, and prevent handwriting errors, thus increasing the quality of recording systems and preventing errors (7,23–27).

Proces digitization allows for better management of resources (20). Our study predicts that a replacement of paper-based documentation systems with COPE and CDSS-supported CLMA systems in the PDC will prevent unnecessary production, movement, transportation, and error waste in the process. Bedside visits are made via tablet computers in the DC and with patient files in the PDC. Making bedside visits with paper-based documents causes unnecessary wastage of transport, movement, and error in the PDC. Bedside visits require using an effective communication process and sharing up-to-date and reliable patient information. The Joint Commission (28) introduced the bedside visit process as a patient safety target and reported that standard deficiencies in nurses' delivery and pick-up processes lead to errors. Ayaad et al. (29) reported that standardized practices in bedside visit processes, which they managed by lean principles, improved the efficiency of the delivery process and decreased error rates. Therefore, the use of tablet computers during bedside visits in the PDC will allow nurses not to use paper patient files during the delivery processes, to access all up-to-date patient data effectively, and eliminate waste areas by ensuring standardization in the processes.

Nursing services require a structured and professional organization adjusted to current medical needs and resources; therefore, there is a need for appropriate protection of resources (30). In this study, according to the current situation VSMs, the time allocated to personal work and the amount of non-productive work was high in both clinics. A transition from paper-based to digital systems is expected to eventually reduce documentation, allowing nurses to allocate more time for direct patient care (22). In the present study, digitalized systems were observed to reduce the time spent on indirect care practices, but contrary to our expectations, the time obtained through digitalized systems was not transferred to direct care practices, causing non-productive, that is, wasted waiting time. The lean approach is applied to work processes by reassigning data collection and monitoring personnel or space and redesigning the process (31). The DC and PDC had comparable patient types and burdens, but the bed occupancy rate was 48% in the DC. Therefore, it has been proposed to combine the PDC with the DC, aiming to use digital applications in PDC work processes and ensuring the use of patient beds at full capacity in the DC. Thus, 10 nurses in the PDC can be used in different areas, preventing waste of waiting time, increasing the time allocated to direct care practices, and reducing the time spent on indirect care practices and personal work. The application of lean principles enables nurses to organize their care processes by considering patients and allows hospital

managers to use personnel effectively, creating added value and high-quality patient care (9).

5. CONCLUSION

In this study, it is predicted that an analysis of clinical processes by lean techniques, determining both waste and value areas and relevant suggestions for proper workflows will increase the time allocated to direct care practices and reduce the time allocated for indirect care practices and personal work. Thus, both time and personnel are used more effectively, and patient safety is increased by reducing human-induced errors.

Analyzing nurses' digitalized workflows using lean methods provides a more accurate view of the process, creating a framework for change management.

The lean approach creates an opportunity to review and improve the processes repeatedly. Therefore, analyzing nursing processes using the lean approach before and after digitalization and reviewing sources of both waste and value will contribute to implementing nursing care practices in a more effective, higher quality, and safer manner and use time and staff more efficiently.

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