

ORIGINAL ARTICLE

## COST ESTIMATE FOR THE MONTHLY SET UP AND OPERATION OF A TELECONSULTATION ROOM

### HIGHLIGHTS

1. It is feasible and possible to reproduce teleconsultation in the health network
2. The study enables discussions about the implementation of teleconsultation.
3. Teleconsultation improves the quality of care and optimizes resources.

Tallita Mello Delphino<sup>1</sup>   
Rosimere Ferreira Santana<sup>2</sup>   
Julianna Nogueira Rodrigues<sup>3</sup>   
Keila Mara Cassiano<sup>4</sup> 

### ABSTRACT

**Objective:** to estimate the cost of setting up and monthly operation of a teleconsultation room. **Method:** descriptive study, carried out by means of a survey of direct and indirect costs for setting up and monthly operation of a teleconsultation room in Niterói - RJ - BR. The data analysis was based on discrimination of the type and quantity of equipment needed to set up the room; and on budgets obtained through research in public tenders and commercial stores. To estimate the running costs, the following were considered: monthly electric power consumption; costs with telephone network, materials, and supplies; and with nurses. **Results:** the minimum cost to set up the room was R\$14,904.17 reais. The average monthly cost for 30 hours per week with three nurses was R\$14,706.95. **Conclusion:** it is believed that teleconsultation can improve access to health care, quality of care and reduce costs related to the health system.

**DESCRIPTORS:** Telenursing; Nursing; Nursing Care; Information Technology; Technology Assessment, Biomedical.

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<sup>1</sup>Universidade do Estado do Rio de Janeiro, Depto. de Enfermagem Médico Cirúrgica da Faculdade de Enfermagem, Rio de Janeiro, RJ, Brasil.

<sup>2</sup>Universidade Federal Fluminense, Depto. de Enfermagem Médico-Cirúrgica da Escola de Enfermagem Aurora de Afonso Costa, Niterói, RJ, Brasil.

<sup>3</sup>Instituto Nacional de Câncer, Rio de Janeiro, RJ, Brasil.

<sup>4</sup>Universidade Federal Fluminense, Departamento de Estatística, Niterói, RJ, Brasil.

## INTRODUCTION

The advent of new technologies allows us to visualize new ways of offering specialized health care. Nursing teleconsultation was authorized and standardized to combat the pandemic caused by the new coronavirus (Sars-Cov-2) in 2020 through consultations, clarifications, referrals, and orientations using information and communication technology and with audiovisual resources and data that allow distance exchange between the nurse and the patient simultaneously or asynchronously<sup>1</sup>. In this format, the first contact with the patient can be virtual, and new prescriptions can be made.

Teleconsultation has been a strong strategy for nursing intervention, by allowing important guidance to be provided to the patient at home, early diagnosis of health needs, prevention of diseases and complications, greater adherence to the proposed treatments and home care<sup>2-5</sup>. Among the conditions that can be approached through teleconsultation, acute and chronic pathologies, urological, ophthalmologic, orthopedic, gastrointestinal, cardiovascular, neurological, dermatological, and gerontological surgical conditions stand out<sup>5-11</sup>.

In the literature it is possible to find clinical trials that evaluate the effect of teleconsultation in adult and elderly patients in the postoperative period of: gastrectomy; colectomy; cholecystectomy and herniorrhaphy<sup>11</sup>; prostatectomy<sup>7</sup>; thigh and hip surgeries<sup>10</sup>; and cataract extraction<sup>2,9</sup>. It was observed in all studies that surgical complications occurred less frequently in the group followed by teleconsultation compared to the group that was not followed, leading us to conclude that patients who are followed in this format have reduced chances of having postoperative complications. In this context, it is essential that this new health care strategy be evaluated regarding its effects and costs involved.

It is considered that providing care guidance through teleconsultation can contribute to reducing hospital costs by avoiding readmissions due to postoperative complications, which would generate more expenses to the institution. These new care strategies using technology have been increasingly implemented to provide accessibility, quality of care, and cost-effectiveness<sup>9,12-13</sup>. Thus, the study aimed to estimate the cost of setting up and the monthly cost of running a teleconsultation room.

## METHOD

This is a descriptive cost study carried out at the Telemonitoring Center for the Elderly located at the Aurora de Afonso Costa Nursing School of the Federal Fluminense University in the city of Niterói/RJ, where we tried to estimate the direct and indirect costs involved in providing the service, as well as establish apportionment criteria (for example, man-hours) for allocation<sup>14</sup>.

In the productive process, cost is a factor that must be analyzed because it consists of an investment of resources in the present that will generate resources in the future, in other words, it corresponds to the portion of the expense that is efficiently consumed in the production of goods and services<sup>14</sup>. Regarding the operational components of services, costs can be direct or indirect. The former are those that can be clearly identified in the provision of a type of service (for example, direct materials, labor, etc.). Indirect costs, on the other hand, are those consumed for the joint provision of different services or those that cannot be attributed to a single type of service (for example, electric energy)<sup>14</sup>.

A teleconsultation room should be air-conditioned and equipped with permanent telemonitoring and teleconferencing equipment. According to the technical recommendation of a professional specialist in Information Technology (IT) of the institution with experience

in setting up and maintaining telemonitoring rooms, consulted for this research, the basic equipment needed and the minimum recommended settings for setting up and maintaining the room, indispensable for each attendant are table, bay for computer supports, chair, computer with I5 processor, 8GB RAM, one TB of ROM memory and 21.5 screen monitor.

For common use, the room must have: one HDL 4x12 PBX; call controller software; call recorder (USB) with all calls digitally recorded and archived; Intelbras HSB 20 headset; Thin Client access terminals; and visual identity. The recommended brands are those that present the best cost-benefit and performance for the proposed activity. Besides this, aiming at the operational and organizational well-being, the room must also have closets, a meeting table, and a bookcase with nursing books. To make the calls, an online software was developed for support during teleconsultation calls. This information system makes it possible to conduct the telephone interview in an organized and fast manner with online filling out of the call instrument, organization and storage of the data collected during the interview.

To estimate the total cost of setting up the room, the types and quantities of equipment and furniture considered by the researchers as basically necessary for the proper functioning of a teleconsultation room, set up for three professionals in attendance (Chart 1). For each piece of equipment and piece of furniture, four independent estimates were made in December 2021, obtained through research in public auctions and commercial stores, and the lowest price was used to calculate the total cost of the room.

**Chart 1** - Equipment and Furniture needed to set up the teleconsultation room, Niterói, RJ, Brazil, 2021

Item	Description of the Product	Amount
1	Computer service desk	03
2	Office Chair with Wheels	03
3	DELL Computer, Inspiron 22 3000 All in One, 21.5" screen, 7th generation Intel Core i5 dual core processor, 8 GB memory, 1TB Storage, keyboard, and mouse	03
4	Telephone set	03
5	Central Phone Station - VONO Virtual PABX Service, 05 extensions, Call queue/ URA, Telephone recording, Fixed number to receive calls	01
6	Telephone and data line	01
7	Headset with Microphone	03
8	HP Printer, Inkjet Multifunction Printer, Model: HP 416 Ink, Monthly Duty Cycle up to 1000 pages	01
9	Whiteboard for Notices and Information 60x90 cm	01
10	Drawer cabinet (with four drawers)	01
11	12,000 BTUS SPLIT air conditioner	01
12	Trash can with pedal	03
13	124L Fridge (socialization function)	01
14	Meeting table with four seats (socialization function)	01
15	Simple fixed chairs for meeting table	04
16	LED Tube Light (18W)	08

Source: Elaborated by the Authors.

To estimate the total cost of running the teleconsultation room active for 30 hours a week, the monthly electricity consumption of each piece of electrical equipment was considered according to: the current value of kilowatt/hour from the local supplier company; the cost of maintaining a telephone network, providing unlimited connection to landlines and cell phones, with data network and minimum speed of 10 MBps; the cost of material and supplies (office supplies); and the monthly labor cost keeping three Nursing Professionals as described in Chart 2.

**Chart 2** - Monthly consumption for teleconsultation room operation, Niterói, RJ, Brazil, 2021.

Item	Description of the Cost
1	Lamps energy consumption
2	Power consumption of the telephone exchange
3	Power consumption of computers
4	Energy consumption of the minibar
5	Cost of telephone and internet network
6	Cost of labor of three Nursing Professionals
7	Cost of Material and Supplies (office material)

Source: Elaborated by the Authors.

For each electrical equipment, the energy consumption for one month was estimated considering:  $E_i \text{ consumption} = (E_i \text{KW power}) \times (\text{Running time h}) \times (\text{KWh price})$ . The reference kilowatt-hour price used was the price charged at the red flag by the local power supply company.

For the costs of telephone and internet networks, independent quotes were also made with several companies offering the service, and the lowest price was used to calculate the total cost of running the teleconsultation room. The quantity of material and supplies needed was estimated by observational analysis of the material used in a teleconsultation room for one month.

As recommended by the Normative Instruction of the Federal Revenue of Brazil No. 1700/2017, considering ten years (120 months) of useful life for furniture and fixtures, and five years (60 months) of useful life for computers, peripherals, electronics, and switchboard technology materials, the following monthly depreciation rates were considered: 0.83% for furniture and fixtures, and 1.67% for computers, peripherals, electronics, and switchboard technology materials.

The monthly cost of professional labor for the call center considered the salary of three nurses for 30 hours per week, estimated by the basic salary of the nurse established by the COREN-RJ. To this monthly salary cost were added: 1/12 of the sum of the employer's costs with labor rights of the three professionals (vacation, 13th salary, INSS and FGTS); and 1/12 of the total cost of three months of a collaborating professional to cover the vacations of the incumbent professionals.

## RESULTS

Chart 3 shows the price quotations for the equipment and furniture needed to set up the teleconsultation room. The prices of the items were determined by research in public biddings and commercial stores, making the quotation in three independent sources. Based on the equipment and furniture price quotations, a total forecast of the cost of setting up the teleconsultation room was made using the lowest prices of the equipment and furniture quotations. It is estimated that the minimum cost for setting up a teleconsultation room is R\$14,904.17.

**Chart 3** - Price quotation of equipment and furniture needed to set up the teleconsultation room, Niterói, RJ, Brazil, 2021.

Items	Budget 1 <sup>(a)</sup>	Budget 2 <sup>(b)</sup>	Budget 3 <sup>(c)</sup>	Budget 4 <sup>(d)</sup>	Amount	Total Price <sup>(e)</sup>
1. computer desk (Unit price)	R\$ 170.38	R\$ 160.18	R\$ 137.38	R\$ 189.90	3	R\$412.14
2. Office chair with wheels (Unit price)	R\$ 168.96	R\$ 131.91	R\$ 149.90	R\$ 189.99	3	R\$395.73
3. Computer with Keyboard and Mouse (Unit Price)	R\$4,539.02	R\$ 3,792.22	R\$ 3,108.00	R\$ 3,650.00	3	R\$9,324.00
4. Telephone set (Unit Price)	R\$ 69.90	R\$ 61.51	R\$ 78.90	R\$ 119.00	3	R\$184.53
5. Telephone exchange (Unit Price)	R\$ 805.88	R\$ 606.23	R\$740.00	R\$ 680.73	1	R\$606.23
6. Earphone with microphone (Unit Price)	R\$ 124.50	R\$ 159.90	R\$ 122.90	R\$ 127.00	3	R\$368.70
7. Printer (Unit Price)	R\$ 1,061.06	R\$ 1,000.38	R\$ 799.90	R\$ 999.10	1	R\$799.90
8. Bulletin board 60x90cm ( Unit Price )	R\$ 111.20	R\$ 61.60	R\$ 85.60	R\$ 55.68	1	R\$55.68
9. Drawer cabinet ( Unit Price)	R\$ 218.49	R\$ 175.12	R\$ 266.90	R\$ 173.90	1	R\$173.90
10. Split air conditioner 12,000 BTUS ( Unit Price )	R\$ 1.188,00	R\$ 1.009,80	R\$1.099,00	R\$ 1.207,44	1	R\$1,009.80
11. Trash garbage can with pedal ( Unit Price)	R\$ 29.99	R\$ 22.87	R\$ 25.99	R\$ 29.90	3	R\$68.61
12. Fridge 124l (Unit Price)	R\$ 759.00	R\$ 774.31	R\$776.99	R\$ 769.00	1	R\$759.00

13. Meeting table ( Unit Price )	R\$ 429.90	R\$ 323.91	R\$ 359.90	R\$ 359.90	1	R\$323.91
14. Fixed chairs for meeting table	84.00	89.97	78.00	84.99	4	R\$312.00
15. Led Tubular Lamp 18W (Unit price)	R\$ 18.35	R\$ 18.34	R\$ 19.79	R\$ 18.35	6	R\$110.04
<b>TOTAL</b>						<b>R\$14,904.17</b>

Source: Elaborated by the Authors.

(a) Quote one from Casas Bahia's website. (b) Quote two from Americanas' website. (c) Quote three from Magazine Luiza's website. (d) Quote four from Submarino's website. (e) Total price calculated considering the lowest price.

Considering monthly depreciation rates of 0.83% for furniture, appliances, and utensils (items one, two, eight, nine, ten, 11, 12, 13 and 14 in Table 3) and 1.67% for computers, peripherals, electronics, and switchboard technology materials (items three, four, five, six, seven and 15) the monthly depreciation cost (MDC) is R\$ 219.41, given by:

$$MDM = 219.41 = 0.83\% \times (412.14 + 395.73 + 55.68 + 173.9 + 1009.8 + 68.61 + 759 + 323.91 + 312) + 1.67\% \times (9.324 + 184.73 + 606.23 + 368.70 + 799.9 + 110.04)$$

Estimates were made of the monthly cost of running the tele-consultation room active for 30 hours a week (six hours a day). We considered the energy consumption of the lamps, the energy consumption of the telephone switchboard, the energy consumption of the computers, the energy consumption of the minibar, the cost of the telephone and internet network, the cost of materials and supplies (office supplies) and the labor cost of three nursing professionals to provide guidance over the phone. In Chart 4 it is possible to see the total cost of energy for teleconsultation room operation monthly, for the different tariffs (green = R\$ 312.94; yellow = R\$ 319.98 and red = R\$ 331.68).

**Chart 4** - Electrical equipment, power of each equipment, operation time in the tele-consultation room, days of operation and total monthly cost according to the price of KWh. Niterói, RJ, Brazil, 2021.

Equipment	Amount	Power (W)	Daily operating time (h)	Days of operation in the month	Estimated monthly running cost at the flag		
					Green (R\$ 0.6682/ KWh)	Yellow (R\$ 0.68322/ KWh)	Red (R\$ 0.70822/ KWh)
Bulb	6	18	6	22	9.5259	9.7400	10.0964
Telephone Switchboard	1	30	6	22	2.6461	2.7056	2.8046
Telephone	3	5	6	22	1.3230	1.3528	1.4023
Computer	3	250	6	22	66.1518	67.6388	70,1138
Fridge	1	220	24	30	105.8429	108.2220	112.1820
Printer	1	45	6	22	3.9691	4.0583	4.2068

Split air conditioner 12.000 BTUS	1	1400	6	22	123.4834	126.2591	130.8791
Total energy cost for monthly operation of the tele-consultation room					312.94	319.98	331.68

Source: Elaborated by the Authors.

The quotation in four telephone service providers in December 2021 resulted in the following budgets for the monthly price of a telephone line with unlimited calls to fixed and cell phones and a data network with a minimum speed of 10 MBps: R\$ 204.79 for the company CLARO, R\$ 168.90 for the company TIM, R\$ 214.89 for the company VIVO, and R\$ 139.90 for the company OI, this being the lowest value considered for the total cost calculation.

As for the cost of office supplies, estimated by observational analysis of the material used in a teleconsultation room for a month, the estimate was R\$ 98.98, presented in Chart 5.

**Chart 5** - Cost of material and supplies for one month in the teleconsultation room, Niterói, RJ, Brazil, 2021.

Cost of Material and Supplies (Office Supplies)	Monthly amount	Unit Price	Total Cost
A4 Sheet	01 ream (500 sheets)	R\$ 17.23	R\$ 17.23
Printer Ink	01 cartridge	R\$ 65.03	R\$ 65.03
Bulletin Board Pen	2 pens	R\$ 8.36	R\$ 16.72
<b>TOTAL</b>			<b>R\$ 98.98</b>

Source: Elaborated by the Authors.

The cost of the three nursing professionals working for 30 hours a week was estimated proportionally to the annual cost of the nursing professional receiving a base salary as established by the COREN-RJ, which is R\$ 3,158.96. Considering all the costs of labor rights and costs: 13th salary (100% of the monthly salary); vacation (one third of the monthly salary); FGTS (8% of the monthly salary); and INSS (14% of the monthly salary), we estimate a monthly cost of R\$ 4,282.15 per professional, thus totaling R\$ 12,846.44 as the monthly cost for three nursing professionals who work 30 hours per week as a call center. Considering, also, three months of salary for a professional to cover one month of vacation for each one of the professionals, this collaborator has the average monthly cost of a room of R\$ 4,282.15, that is, R\$ 1,070.53.

Considering the data above: the cost of monthly depreciation (R\$ 219.41); the consumption of energy at the red flag (R\$ 331.68); the consumption of telephone and internet network (R\$ 139.90); the cost of office materials and supplies (R\$ 98.98); the monthly cost of three nursing professionals (R\$ 12,846.45); and the relative monthly cost of an auxiliary professional to cover vacations of the three titular professionals (R\$1,070.53), it is estimated that the monthly operational cost of a teleconsultation room with three nurses

working the same hours and completing 30 hours a week each is R\$ 14,706.95.

## DISCUSSION

Currently, the growing evolution of information technologies is transforming society. The topics technology and technological innovation are on the media agenda and on the agendas of governments, companies, research funding agencies, and several social organizations with strong influence in the health sector. Such technological development has triggered a recognition of the current society as one of knowledge and technology<sup>3,15</sup>.

Similarly, the health field has also been transforming due to growth and technological innovations. This fact has been marked by the introduction of a large volume of technologies, instruments, diagnostic and therapeutic resources, producing significant changes in daily health practices, diagnostic processes, and the therapeutics used<sup>3,12-15</sup>.

Studies show that teleconsultations have been used by nurses as a strategy for the patient and family education process, health control, identification of signs of health complications, and prevention of diseases. The orientations provided by telephone are part of nursing education strategies, being effective in health promotion with consequent improvement in knowledge and self-care<sup>2-4,12</sup>.

Considering COFEN Resolution No. 568/2018, which regulates the operation of Nursing Offices and Clinics<sup>16</sup>, the pandemic caused by the new coronavirus (COVID-19) in 2020 and the importance of the participation of nurses in fighting the pandemic through consultations, clarifications, referrals, and guidance, especially in moments of social isolation, in which people need access to safe information and with the possibility of care without traveling to health units, on March 26, 2020, COFEN Resolution No. 634/2020 was created. This Resolution authorized and has regulated, "ad referendum" of the COFEN Plenary, the nursing teleconsultation to fight the pandemic caused by the new coronavirus (Sars-Cov-2) through consultations, clarifications, referrals, and orientations with the use of information and communication technology and with audiovisual resources and data that allow the distance exchange between the nurse and the patient simultaneously or asynchronous<sup>1</sup>.

This fact has given even more prominence to the possibilities of remote, sensitive, and qualified follow-up, maintaining continuity of care. Thus, cost studies can help in the evaluation of these new technologies for care, which have shown, with the pandemic, "that they are here to stay. The use of new technologies for health care aims to provide accessibility, quality care, cost-effectiveness, and cost-effectiveness<sup>9,12,17-18</sup>.

In this context, it is essential that these new technologies incorporated into health care be evaluated for their effects and costs involved. After all, when there is a need to decide about a particular technology that should be used for prevention, diagnosis, treatment, or rehabilitation incorporated or not into the system, cost evaluations represent an important tool in the decision-making process and allocation of health resources<sup>18</sup>.

As a limitation of the study, it was not possible to estimate how many patients can be seen per month by three nursing professionals, since the number of patients seen will depend on the duration of the calls, which is directly associated with the type of clientele being seen (young, adult, elderly, acute, chronic, and respective conditions).



## CONCLUSION

According to the data obtained, it was possible to estimate the costs for setting up the teleconsultation room as well as to estimate the monthly costs for maintenance and necessary inputs, which leads to the conclusion that teleconsultation can be a possible model of care to be reproduced in the health network. It is noteworthy that the cost estimates provided in this study are minimum estimates that are useful for both public and private services. Public and private institutions working with higher quality standards of equipment, materials and/or professional salaries than specified in the predictions of this paper should add such differences to their cost estimates.

It is believed that the findings of this study can contribute to discussions about the implementation, maintenance, and consolidation of a broad communication network between the different health services, enabling direct and continuous communication between patients and professionals, strengthening the relationship of trust, the capacity for self-care, adaptation to acute and chronic health situations and, consequently, the reduction of costs in the health system. Thus, it is believed that teleconsultation, when implemented, will expand access to health care, guarantee the quality of care, and optimize resources.

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**Corresponding author:**

Rosimere Ferreira Santana

Universidade Federal Fluminense

Rua Dr. Celestino, nº 74 – CEP: 24020-091 – Niterói, RJ, Brasil

E-mail: rosifesa@gmail.com

**Role of Authors:**

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work

- **Delphino TM, Santana RF, Rodrigues JN, Cassiano KM**; Drafting the work or revising it critically for important intellectual content

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