

Aspiration Risk: Development of a Learning Object for Nursing Using Gastric Ultrasonography

Risco de Aspiração: Criação de Objeto de Aprendizagem para Enfermagem Utilizando Ultrassom Gástrico
Riesgo de Aspiración: Desarrollo de Un Objeto de Aprendizaje para Enfermería Mediante Ecografía Gástrica

RESUMO

Objetivo: Desenvolver um protótipo de objeto de aprendizagem para apoiar profissionais de enfermagem na realização da ultrassonografia gástrica em internados na Unidade de Terapia Intensiva. **Método:** Estudo exploratório e descritivo, voltado à criação de um objeto de aprendizagem para auxiliar o uso do ultrassom gástrico por enfermeiros. **Resultado:** Desenvolvido um card interativo com QR Code, destinado ao ensino da ultrassonografia gástrica e da avaliação do risco de broncoaspiração. O protótipo foi avaliado por 17 participantes por meio de formulário eletrônico. **Conclusão:** O material mostrou-se útil para ampliar conhecimentos e desenvolver habilidades. Com base nas sugestões dos participantes, foi elaborada uma versão aprimorada do card, tornando-o mais completo e aplicável à prática clínica e ao processo de ensino assistencial.

DESCRIPTORES: Ultrassonografia; Aprendizagem; Enfermagem; Aspiração Respiratória de Conteúdos Gástricos; Unidades de Terapia Intensiva.

ABSTRACT

Objective: To develop a prototype learning object to support nursing professionals in performing gastric ultrasonography in patients admitted to the Intensive Care Unit. **Method:** Exploratory and descriptive study aimed at developing a learning object to support nurses in the use of gastric ultrasound. **Results:** An interactive card with a QR Code was developed to support the teaching of gastric ultrasonography and the assessment of aspiration risk. The prototype was evaluated by 17 participants through an electronic questionnaire. **Conclusion:** The material proved useful for expanding knowledge and developing skills. Based on the participants' suggestions, an improved version of the card was developed, making it more comprehensive and applicable to clinical practice and nursing education.

DESCRIPTORS: Ultrasonography; Learning; Nursing; Respiratory Aspiration of Gastric Contents; Intensive Care Units.

RESUMEN

Objetivo: Desarrollar un prototipo de objeto de aprendizaje para apoyar a los profesionales de enfermería en la realización de la ecografía gástrica en pacientes ingresados en la Unidad de Cuidados Intensivos. **Método:** Estudio exploratorio y descriptivo, orientado al desarrollo de un objeto de aprendizaje para facilitar el uso de la ecografía gástrica por enfermeros. **Resultados:** Se desarrolló una tarjeta interactiva con código QR, destinada a la enseñanza de la ecografía gástrica y la evaluación del riesgo de broncoaspiración. El prototipo fue evaluado por 17 participantes mediante un formulario electrónico. **Conclusión:** El material demostró ser útil para ampliar conocimientos y desarrollar habilidades. A partir de las sugerencias de los participantes, se elaboró una versión mejorada de la tarjeta, haciéndola más completa y aplicable a la práctica clínica y al proceso de enseñanza en enfermería.

DESCRIPTORES: Ultrasonografía; Aprendizaje; Enfermería; Aspiración Respiratoria de Contenidos Gástricos; Unidades de Cuidados Intensivos.

Marcella Barreto Maia Caldas

Nurse. Rio de Janeiro State University
ORCID: <https://orcid.org/0000-0001-6884-7417>

Gabriella de Carvalho Lourenço de Souza

Nurse. Rio de Janeiro State University
ORCID: <https://orcid.org/0009-0000-7706-3980>

Andrezza Serpa Franco

Ph.D. in Nursing. Rio de Janeiro State University.
ORCID: <https://orcid.org/0000-0001-5008-1345>

Elson Santos de Oliveira

Ph.D. in Nursing. Rio de Janeiro State University.
ORCID: <https://orcid.org/0000-0001-9377-0140>

Josiana Araujo de Oliveira

Ph.D. in Nursing. Rio de Janeiro State University.
ORCID: <https://orcid.org/0000-0001-6625-4685>

Carolina da Costa Lipari

Specialist Nurse. Veiga de Almeida University.
ORCID: <https://orcid.org/0000-0003-2411-2659>

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INTRODUCTION

With technological advances, ultrasound equipment has become more compact and portable while maintaining high image quality. Thus, bedside ultrasound has become a reality, serving as an

extension of the physical examination to complement the diagnostic evaluation of patients. This focused bedside ultrasound technique is called point-of-care ultrasound (POCUS)¹.

In this context, the relationship between nursing practice and ultrasonography began with Federal Council Opinion No. 206/2015/COFEN regarding the performance of obstetric ultrasonography, which was subsequently regulated by COFEN Resolution No. 627/2020, with the aim of achieving greater autonomy in patient care. Furthermore, another opinion issued by the Federal Council, No. 243/2017/COFEN, pertains to the standardization of the procedure for the insertion, securing, maintenance, and removal of peripherally inserted central catheters (PICCs) by nurses with the aid of ultrasound^{2,3,4}.

Recently, the Federal Nursing Council (COFEN) approved Resolution No. 679/2021, which regulates the performance of bedside and pre-hospital ultrasound by nurses. Thus, registered nurses must have specific training in ultrasound, and they are prohibited from issuing ultrasound reports or using ultrasound for the purpose of nosological diagnosis. In this context, COFEN establishes as a professional right the ability to practice nursing with autonomy and safety⁵.

With the use of POCUS, gastric ultrasound allows for the qualitative and quantitative assessment of gastric contents, distinguishing between an empty stomach and the presence of solid or liquid contents, and contributing to the stratification of the risk of bronchoaspiration. Thus, POCUS becomes an important tool for assessing gastric contents and aiding in clinical decision-making, especially when the risk of aspiration is uncertain⁶.

Nurses are qualified to perform ultrasound examinations; however, its use is still relatively new in professional practice and has been given

little attention in academic training, highlighting the need for educational materials and protocols⁷. Given this, the research question was: Do nursing professionals have the skills to perform gastric ultrasound to assess the risk of bronchoaspiration? The objective was to develop a prototype learning object aimed at nursing professionals to facilitate the performance of bedside gastric ultrasound in adult patients admitted to the intensive care unit, with the goal of assessing the risk of bronchoaspiration.

METHOD

This is an exploratory and descriptive study, classified as applied research in technology development, conducted in October 2024, with the objective of developing a prototype learning object to facilitate the use of gastric ultrasound by nursing staff. The prototype was developed based on the scientific literature and consists of a physical, visual card placed next to the ultrasound machine, containing step-by-step instructions for gastric ultrasonography and a QR code providing access to an educational video, thereby facilitating consultation and learning of the technique.

The study was conducted at a university hospital located in the city of Rio de Janeiro, in a surgical cardiac intensive care unit, where activities took place in a structured training environment configured to simulate a hospital bed equipped with an ultrasound machine, and in a general ICU, where data collection took place in a real clinical setting, at the bedside, during physical examinations of hospitalized patients conducted by nursing students.

The study participants were nursing students from public and private universities who were completing their supervised clinical rotations, as well as nursing residents from pro-

grams rotating through the unit. Excluded from the study were students and residents on leave, those who had graduated, and volunteers who, during the examination, presented any changes in clinical findings that required intervention or action by the multidisciplinary team.

The prototype was developed in five phases: analysis, design, development, implementation, and evaluation, involving nursing students and residents. During the analysis phase, a literature review on ultrasound techniques was conducted, while the design phase focused on pedagogical and technological strategies for developing a visual and user-friendly educational tool. Evaluation was conducted using a Likert scale for satisfaction and usability, with a random, purposive, and non-probabilistic sample of nursing students and residents.

To characterize the research sample, a *Google Forms*® questionnaire was used to gather participant information. This questionnaire also collected data from the *Likert* scale following the use of ultrasound with the prototype, and the Informed Consent Form (ICF) for participation in the study was included in this same questionnaire.

For data analysis, responses were extracted from the *Google Forms*® summary and grouped and categorized by dimensions: 1) Visualization and design of the *Card* using the Likert scale; 2) Understanding of the topic using the Likert scale; 3) Participants' opinions. The scale consisted of five response options, namely: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. Subsequently, charts were generated using the *Google Forms*® platform software, containing the participants' responses for further analysis.

It should be noted that this study is part of a scientific research project titled: "Pulmonary Congestion in

Heart Failure: The Use of Ultrasound by Nurses,” and is in accordance with Resolution No. 466 of 2012 of the National Health Council, which regulates research involving human subjects and was approved by the Substantiated Opinion of the Institutional Review Board (IRB) 6.268.007. The objective of this project is to develop

learning materials using ultrasound.

RESULTS

As a result of this research, a prototype of a learning object (LO) was developed using a visual representation of an instrument (Card) linked to a QR code, which directs the user to

an explanatory video to assist in performing a gastric ultrasound exam.

Figure 1: Front view of the first version of the LO prototype for performing a gastric ultrasound exam. Rio de Janeiro, 2024.

Instruções:

- 1 Ligue o aparelho de USG;
- 2 Escolha o Probe (transdutor) convexo e conecte no aparelho;
- 3 Eleve a cabeceira à 45 graus;
- 4 Posicione o paciente em posição supina. Caso fique de difícil análise, troque a posição para decúbito lateral direito;
- 5 Exponha o abdômen superior do paciente;
- 6 Localize a região sonoanatômica de interesse: Antro gástrico (região epigástrica, aproximadamente 3 a 4cm abaixo do apêndice xifoide);
- 7 Coloque gel no Probe;
- 8 Posicione o Probe na posição vertical com o index para a região cefálica;

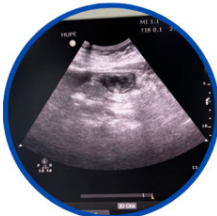


- 9 Realize a inssonação do estômago;



- 10 Avaliação qualitativa: realize a interpretação das imagens;

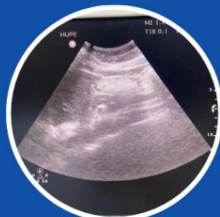
- Antro vazio: pequeno e colapsado (aparência de olho de boi).
Indica baixo risco de broncoaspiração.



- Antro contendo volumes variados de líquidos/fluidos: redondo e distendido.
Indica baixo risco <1,5ml/kg ou alto risco >1,5ml/kg.



- Antro contendo sólidos: redondo e distendido (aparência de vidro fosco).
Indica alto risco de broncoaspiração.



- 11 Avaliação quantitativa: realizar no antro contendo líquidos ou quando há dúvidas na avaliação qualitativa;
- 12 Realize a medição do antro gástrico;

- 12.1- Ao encontrar o antro, aperte a tecla que irá congelar a sua imagem.
- 12.2- Aperte a tecla do seu USG que realizará a medição da imagem. Com o “mouse” vá até as extremidades do antro e realize a medida céfalo caudal (+).
- 12.3- Faça o mesmo para a medida antero posterior (X). Dessa forma, aparecerá as 2 medidas na tela.



Source: The authors, 2024.

Figure 2: Back of the first version of the LO prototype for performing a gastric ultrasound exam. Rio de Janeiro, 2024.

13 Realize o cálculo para obter a avaliação quantitativa:

$$\frac{CC \times AP \times 3,14}{4}$$

14 Identifique a idade e o peso do paciente;

15 Conforme o resultado do cálculo, correlacione na tabela o valor encontrado e a idade do paciente;

Right lat CSA (cm ²)	Age (years)							
	20	30	40	50	60	70	80	
3	45	32	20	7	0	0	0	
5	74	62	49	36	23	10	0	
7	103	91	78	65	52	40	27	
9	133	120	107	94	82	69	56	
11	162	149	136	123	111	98	85	
13	191	178	165	153	140	127	114	
15	220	207	194	182	169	156	143	
17	249	236	224	211	198	185	173	
19	278	266	253	240	227	214	202	
21	307	295	282	269	256	244	231	
23	337	324	311	298	285	273	260	
25	366	353	340	327	315	302	289	
27	395	382	369	357	344	331	318	
29	424	411	398	386	373	360	347	

16 Divida o número encontrado na tabela pelo peso do paciente;

17 Classifique o risco de broncoaspiração de acordo com os resultados encontrados.



Acesse através do qrcode o vídeo explicativo da técnica.

Instrumento desenvolvido por:

Gabriella de Carvalho Lourenço de Souza e Marcella Barreto Maia Caldas

Internas em Enfermagem

Andrezza Serpa Franco e Elson Santos de Oliveira

Orientadores





Técnica para realizar Ultrassonografia do estômago e avaliar o risco de broncoaspiração

Um instrumento que irá auxiliar na prática clínica do USG gástrico.

Source: The authors, 2024.

The study included 17 volunteers, comprising 14 10th-semester nursing students and 3 nursing residents. Participants received the Card and watched the explanatory video via the QR code before performing the ultrasound. After the practice session, they assessed their satisfaction with and the usability of the prototype using a Likert scale in a Google Forms® survey. The data were compiled and presented in graphs based on the responses obtained.

DISCUSSION

Regarding prior experience with ultrasound, 47.1% of the participants had never used the device at the bedside, indicating that the practice of POCUS is still in its early stages in nursing. The limited availability of equipment and the lack of systematic training in undergraduate programs hinder the learning of the technique, reinforcing the need for academic updates and professional training to ensure its proper use in clinical practice^{5,7}.

Regarding the legibility of the fonts used on the card, 64.7% of participants strongly agreed and 35.3% agreed.

Regarding the colors, 70.6% strongly agreed and 29.4% agreed with the choice made. These results demonstrate good acceptance of the visual elements of the material, highlighting the importance of appropriate graphic design to organize information clearly and facilitate understanding^{8,9,10}.

Regarding the images used on the card, 88.2% of participants agreed or strongly agreed that they were appropriate, while 5.9% remained neutral and 5.9% disagreed, indicating good acceptance, although there is a need to improve the clarity of the images. As for the clarity of the instructions, 100%

of the participants agreed or strongly agreed, reinforcing the importance of objective communication in the teaching-learning process. This result is significant, especially since no prior training was provided, highlighting the card's potential as an instructional resource to support learning¹¹.

Regarding the influence of the ultrasound machine model on the card's applicability, responses were mixed: 35.3% strongly agreed, 23.5% agreed, 17.6% were neutral, and 23.5% disagreed. A lack of standardization of equipment at the facility was observed, along with difficulties in its use, requiring the researchers to intervene to turn on the machine and connect the probe. In this context, standardizing technologies can minimize variables¹².

Regarding learning how to use

ultrasound and locate the gastric antrum, which is relatively straightforward, it was observed that 58.8% of participants strongly agreed, 35.3% agreed, and 5.9% neither agreed nor disagreed regarding the ease of using ultrasound and finding the gastric antrum. Although it is a new and recently implemented technology, handling POCUS was not particularly difficult, though it required more prior training tailored to the specific features of the available device.

Regarding the possibility of learning to assess the risk of aspiration using the explanatory images and the calculation presented on the card, it was found that 64.7% of participants strongly agreed, 29.4% agreed, and 5.9% disagreed. Despite the high agreement rate (90%), it was observed that the researchers had to intervene

to assist with performing the calculation. Calculating gastric content is not a simple task. Thus, it is clear that despite the explanation provided on the card, there is still a need for prior training on the subject.

In the evaluation of the video as an instructional resource, it was found that 76.5% of participants strongly agreed, 17.6% agreed, and 5.9% remained neutral regarding its effectiveness in explaining the technique. The video, accessible via the QR code provided on the card, visually presents all the steps necessary to perform gastric auscultation, in line with the written content.

Thus, based on the participants' feedback and the analysis of the results obtained, a new learning tool was developed.

Figure 3: Front of the final, redesigned card. Rio de Janeiro, 20243

Instruções:

- 1 Ligue o aparelho de USG;
- 2 Escolha o Probe (transdutor) convexo e conecte no aparelho;
- 3 Eleve a cabeceira à 45 graus;
- 4 Posicione o paciente em posição supina. Caso fique de difícil análise, troque a posição para decúbito lateral direito;
- 5 Exponha o abdômen superior do paciente;
- 6 Localize a região sonográfica de interesse: Antro gástrico (região epigástrica, aprox 3 a 4cm abaixo do apêndice xifoide);
- 7 Coloque gel no Probe. Certifique-se que ao colocar o gel apareça a imagem no ultrassom;
- 8 Posicione o Probe na posição vertical com o index para a região cefálica;

9 Realize a insinuação do estômago;



ANTRO GÁSTRICO
POSSUI FORMATO REDONDO

10 Realize a interpretação das imagens: avaliação qualitativa;

- Antro vazio: pequeno e colapsado; aparência de "olho de boi".
Indica baixo risco de broncoaspiração.
- Antro contendo sólidos em estágio inicial: redondo e distendido; aparência de "vidro fosco".
Indica alto risco de broncoaspiração.
- Antro contendo sólidos em estágio tardio: redondo e distendido; aparência hiperecôico - muito cinza.
Indica alto risco de broncoaspiração.

- Antro contendo volumes variados de líquidos/fluidos: redondo e distendido.
Indica baixo risco <1,5ml/kg ou alto risco >1,5ml/kg.
- Antro contendo líquidos com bolhas de gases: aparência de "noite estrelada".
Indica baixo risco <1,5ml/kg ou alto risco >1,5ml/kg.



FIGADO L R A ANTRO GÁSTRICO AORTA



FIGADO L R A ANTRO GÁSTRICO AORTA



FIGADO L R A ANTRO GÁSTRICO AORTA

11 Avaliação quantitativa: realizar no antro contendo líquidos ou quando há dúvidas na avaliação qualitativa;

12 Para realizar a avaliação quantitativa: faça a medição do antro gástrico;

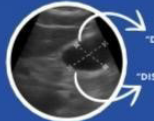
12.1- Ao encontrar o antro, aperte a tecla que irá congelar a sua imagem.

12.2- Aperte a tecla do seu USG que realizará a medição da imagem. Siga até as extremidades do antro e realize a medida céfalo caudal (distância 1).

12.3- Faça o mesmo para a medida antero posterior (distância 2). Dessa forma, aparecerá as 2 medidas na tela.

Source: The authors, 2024.

Figure 5: Back of the final revised card. Rio de Janeiro, 2024.



13 Realize o cálculo para obter a avaliação quantitativa:

$$\frac{CC \times AP \times 3,14}{4}$$

14 Identifique a idade do paciente;

15 Conforme o resultado do cálculo, correlacione na tabela o valor encontrado e a idade do paciente;

Idade (em anos)	20	30	40	50	60	70	80
2	31	58	7	0	0	0	0
3	45	12	20	7	0	0	0
4	60	47	54	21	9	0	0
5	74	62	49	56	25	10	0
6	89	76	63	55	38	25	12
7	103	91	78	65	52	40	27
8	118	105	95	80	67	54	41
9	133	120	107	94	82	69	56
10	147	135	122	109	96	85	71
11	162	149	136	125	111	98	86
12	177	164	151	138	125	113	100
13	191	178	165	153	140	127	114
14	206	193	180	167	155	142	129
15	220	207	194	182	169	156	145
16	235	222	209	198	184	171	159
17	249	236	224	211	198	185	175
18	264	251	239	226	213	200	187
19	278	266	255	240	227	214	202
20	293	281	268	255	242	229	217
21	307	295	282	269	256	244	231
22	323	310	297	284	271	259	246
23	337	324	311	298	285	273	260
24	352	339	326	315	301	288	275
25	366	353	340	327	315	302	289
26	381	368	355	345	330	317	304
27	395	382	369	357	344	331	318
28	410	397	385	372	359	346	333
29	424	411	398	386	375	360	347
30	439	427	414	401	388	375	365

16 Divida o número encontrado na tabela pelo peso do paciente;

17 Classifique o risco de broncoaspiração de acordo com os resultados encontrados.

Acesse através do qrcode o vídeo explicativo da técnica.



Instrumento desenvolvido por:

Gabriella de Carvalho Lourenço de Souza e Marcella Barreto Maia Caldas

Internas em Enfermagem

Andreza Serpa Franco e Elson Santos de Oliveira



Rio de Janeiro, 2024.



Técnica para realizar Ultrassonografia do estômago e avaliar o risco de broncoaspiração

Um instrumento que irá auxiliar na prática clínica do USG gástrico.

Source: The authors, 2024.

Regarding the changes made to the card, an image was added to illustrate the anatomical location of the gastric antrum, given the difficulty observed in identifying it. The image quality was also improved, and new representations of the stomach under different conditions were added, including early-stage solid contents, late-stage solid contents, and liquid contents with gas bubbles. In addition, the table was modified to improve the presentation and comprehension of the information.

CONCLUSION

During the practical sessions, the participants showed great enthusiasm, especially for learning how to use ultrasound and for identifying the gastric antrum. This enthusiasm may have influenced their responses to the questionnaire, introducing a potential confounding bias between the knowledge acquired and the excitement experienced during the activity. The OA, developed in card format, proved satisfactory, contributing

to the acquisition of theoretical and practical knowledge and the development of skills in gastric ultrasonography and the assessment of the risk of bronchoaspiration.

Despite the positive results, difficulties were identified in handling the equipment and in understanding anatomical and physiological aspects, highlighting the need for prior, systematic training. The participants' contributions allowed for the refinement of the prototype, making it more comprehensive and better suited to practical demands. It is concluded that the OA shows potential as a complementary strategy in nursing education and in improving the quality of care; further studies with larger samples and different clinical settings are recommended.

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