ORIGINAL ARTICLE

HEART RATES AND CARDIOPULMONARY ARREST OUTCOMES IN EMERGENCY UNITS
RITMOS CARDÍACOS E DESFECHO DE PARADA CARDIOPULMONAR EM UNIDADE DE EMERGÊNCIA
RITMO CARDÍACO Y DESENLACE DEL PARO CARDIORRESPIRATORIO EN UNIDAD DE URGENCIA

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ABSTRACT
Objective: to recognize and characterize the cardiac rates and the outcome of patients in cardiopulmonary arrest (CPA) in an emergency unit. *Method*: cross-sectional study, with a quantitative approach, developed in the emergency sector of a public hospital of the Federal District, Brazil. The data collection was performed by means of a structured questionnaire from medical records. For storage of the records, a database was built in an Excel spreadsheet. The results were considered significant with p<0.05. *Results*: from a total of 36 patients, the majority (55.3%) were female. The pulseless electrical activity (PEA) was the most frequent CPA rate (36.8%), followed by asystole (21.1%) and ventricular fibrillation in 7.9% of the cases. Death was the outcome in 60.5% of the patients. *Conclusion*: CPA was determined predominantly by the PEA rate. The predominant outcome among the patients was death. *Descriptores*: Cardiac Arrest; Outcome; Emergency Medical Services.

RESUMO
Objetivo: reconhecer, ao caracterizar, os ritmos cardíacos e o desfecho de pacientes em parada cardiopulmonar **(PCR)** em uma unidade de emergência. *Método*: estudo transversal, com abordagem quantitativa, desenvolvido no setor de emergência, de um hospital da rede pública do Distrito Federal. A coleta de dados foi realizada por meio de questionário estruturado a partir dos registros de prontuário. Para armazenamento dos registros, foi construído um banco de dados na planilha do Excel. Foram considerados significativos os resultados com p<0,05. *Resultados*: do total de 36 pacientes, a maioria (55,3%) era do sexo feminino. A atividade elétrica sem pulso (AESP) foi o ritmo de PCR mais frequente (36,8%), seguido de assistolia (21,1%) e fibrilação ventricular em 7,9% dos casos. O óbito foi o desfecho de 60,5% dos pacientes. *Conclusão*: a PCR foi determinada predominantemente pelo ritmo AESP. O desfecho predominante entre os pacientes foi o óbito. *Descritores*: Parada Cardíaca; Desfecho; Serviços Médicos de Emergência.

RESUMEN
Objetivo: reconocer, al caracterizar, el ritmo cardíaco y el desenlace de pacientes con paro cardiorrespiratorio **(PCR)** en unidad de urgencia. *Método*: estudio transversal, con enfoque cuantitativo, desarrollado en el sector de urgencia de un hospital de la red pública, en el Distrito Federal, Brasil. La recolección de datos se realizó a través de una encuesta estructurada, a partir de los registros de la historia clínica. Para almacenar los registros, se construyó un banco de datos en una planilla Excel. Se consideraron de importancia los resultados con p<0,05. *Resultados*: de un total de 36 pacientes, la mayoría (55,3%) era del sexo femenino. La actividad eléctrica sin pulso (AESP) fue el ritmo de PCR más frecuente (36,8%), seguido de asistolia (21,1%) y fibrilación ventricular en 7,9% de los casos. Se dieron casos de óbito, como desenlace, en 60,5% de los pacientes. *Conclusión*: la PCR se determina principalmente por el ritmo AESP. El principal desenlace entre los pacientes fue el óbito. *Descriptores*: Paro Cardíaco; Desenlace; Servicios Médicos de Urgencia.

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INTRODUCTION

In the intra-hospital context, while the cardiopulmonary arrest (CPA) is a devastating event, which may occur in some moment of hospitalization of patients and is associated with high mortality,[1] cardiopulmonary resuscitation (CPR) is a procedure adopted in the intra and extra-hospital scenario to save lives and when performed effectively and early diagnosis may improve the outcome of patients.[2,3]

The goal of CPR is the prevention of premature cardiovascular death. The occurrence of a CPA or other emergency that expose the life at risk, requires a rapid and skillful response to maintain the survival without sequels.[4]

Scientific evidences reveal the existence of a relationship between the factors pre-arrest and the survival after resuscitation. This context is usually consists of hospitalized patients with poor prognosis, patients with underlying diseases of the circulatory system, respiratory and neurological and malignant diseases.[5]

The lack of implementation of evidence-based programs in order to train teams for CPA compliance as well as for the use of resuscitation techniques and equipment represents a gap.

Knowingly, all hospital employees must know how to recognize a CPA, ask for help, perform chest compressions, and use an automated external defibrillator (AED), until the staff trained in the care of patients in CPA respond to the event.[1]

Education and training of personnel to meet the CPA are key conditions for better performance and satisfactory results. Therefore, there are aspects of the training and retention of abilities related to care that are unique to the hospital environment and require permanent education of the team for the development of competences, minimizes errors and optimization of results.[6-8] One example, are the simulated practice that can contribute to the training of personnel.[9]

In this scenario, the clinical indicators are tools adopted by the team and that usually indicate the clinical deterioration in the majority of patients in pre-CPA. Thus, these indicators may subsidize the implementation of rapid response systems or early warning systems as an opportunity for a systemized and early intervention in these patients.[10] The prognostic post-CPA is generally associated with the response time.[10] In this configuration, rapid response systems can improve the results of patients after hospital CPA.

Given the aforementioned, the guiding question of this study is based on characterizing and recognizing the rates and outcome of the CPA patients in the emergency unit of a public hospital of the Federal District in Brazil.

Surely, the nurse is responsible for conducting the primary evaluation and the start of CPR maneuvers. Therefore, it is up to this professional registration of full and detailed information, which requires knowledge, competence and availability of this professional.[12]

In this scenario, the rationale of this study is due to lack of scientific evidence for targeting skilled management in order to subsidize the construction of strategies/warning systems for the prevention and early CPA detection.

OBJECTIVES

To recognize and characterize the cardiac rates and the outcome of patients in cardiopulmonary arrest (CPA) in an emergency unit.

● Check the demographic profile of the patients in cardiopulmonary arrest admitted to the emergency unit.

● characterize the outcome of patients who evolved in cardiopulmonary arrest in an emergency unit.

METHOD

Cross-sectional study, with a quantitative approach, developed in the emergency sector of a public hospital of the Federal District, Brazil.

The data collection occurred during the period of June to December 2014. A convenience sample was composed of 36 patients admitted in the emergency sector, with cardiopulmonary arrest registered in their medical records.

Patients aged over 18 years of age, cardiopulmonary arrest history on their medical records have been included.

Patients admitted to the emergency department were excluded cardiopulmonary arrest history in extra-hospital environment, a situation that could influence the prognosis and outcome of the patient; patients under palliative care, lack of records about the event.

The identification of cases occurred from the consultation of electronic medical records. For the data collection purposes in this study the cardiopulmonary arrest was

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defined according to the Utstein model as cessation of activity cardiac mechanics confirmed by the absence of a pulse and detectable apnoea (or agonic respiration),[13] while the cardiopulmonary resuscitation consisted both in the supply of basic and advanced life support .

The protocol for data collection was divided into phases:

Phase I: Daily the computerized database of records available in the institution in search of occurrence of cardiopulmonary arrest emergency unit records was consulted.

Phase II: Eligible patients have a CPA case record in their files. These data were recorded in a data collection questionnaire structured, based on the Utstein model, consisting of questions regarding the identification of the patient (sex, weight, height, age), clinical aspects (clinical, hemodynamic, and neurological variables) and patient outcome (discharge, death).

Phase III: The data obtained were registered in the excel spreadsheet for posterior analysis.

This project was submitted to and approved by the Ethics Committee of the Foundation to Teaching and Research in Health Sciences - FEPECS (CAAE: 30848214.6.0000.5553) obeying the Resolution 466/2012. All participants included in the study gave consent to participation in the study by signing the Free and Informed Consent Term (FICT) by the legal representative.

For storage of the records, a database was built in an Excel spreadsheet. Later the data was transferred and analyzed using Epi Info software (version 3.4.3). For a description of results were calculated relative and absolute frequencies, mean and standard deviation and median (percentile 25% and 75%). For the comparison between the groups, the Mann-Whitney test was used. The result was considered significant when $p<0.05$.

RESULTS

It was found that the average age of patients with cardiopulmonary arrest was 64 ± 14 years. From a total of 36 patients, the majority (55.3%) were female. The most frequent comorbidities were hypertension (50%), diabetes *mellitus* (28.9%), chronic renal failure and stroke (5.3%), respectively. During the event of CPA the adrenaline was the drug administered in 50% of the situations, followed of noradrenaline (28.9%) and 8.4% sodium bicarbonate in 15.8% of cases.

The pulseless electrical activity (PEA) was the most frequent CPA rate (36.8%), followed by asystole (21.1%) and ventricular fibrillation in 7.9% of the cases. The service time of the CPR in the majority (47.4%) of the cases was higher than 10 minutes. The call occurred between 5 and 10 minutes in 15.8% of cases and in 2.6% of cases, the time was less than or equal to 5 minutes. The young patient (below the age of 60 years) presented time of more prolonged cardiopulmonary resuscitation (median of 40 minutes) and p=0.006 (Mann-Whitney test). The CPR time showed association with the occurrence of death (p=0.004) by Mann-Whitney test. From the total patients in CPA, the outcome of 60.5% was death at the end of the service.

The resuscitation time in males surpassed the female and this relationship was significant (p=0.04) by the Mann-Whitney test.

At all events, the CPA care was performed by physicians, nurses and physiotherapists. The most frequent symptom (40%) prior to the CPA was respiratory failure and in 20% of cases, hypotension.

Table 1 shows the characterization and distribution of patients according to CPA rate.

Table 1. Characterization and distribution of patients admitted to the emergency unit according to cardiopulmonary arrest. Federal District, 2015.

Variables	VF (n=3)	PEA (n=14)	Asystole (n=8)
Female	1 (2.6%)	7 (18.4%)	6 (15.8%)
Male	2 (5.3%)	7 (18.4%)	2 (5.3%)
Age* (years)	77 (60 – 77)	68.5 (58 – 79)	64.5 (55 – 74)
Death	1 (2.6%)	6 (15.8 %)	3 (7.9%)
Time of CPR <= 5 min	0 (0.0%)	1 (2.6%)	0 (0.0%)
Time of CPR > 5 min and <= 10 min	0 (0.0%)	2 (5.3%)	4 (10.5%)
Time of CPR > 10 minutes	2 (5.3%)	9 (23.7%)	3 (7.9%)
Use of adrenaline	2 (5.3%)	9 (23.7%)	5 (13.2%)
Use of non-adrenaline	0 (0.0%)	6 (15.8 %)	5 (13.2%)

Data expressed in % of the total of patients; * Data expressed in median (25% - 75%);** 13 patients without data; CPR - cardiopulmonary resuscitation; VF - ventricular fibrillation; PEA - pulseless electrical activity; min - minutes.

DISCUSSION

The care measures for assisting patients in cardiopulmonary arrest must be guided by the best practices and these are divided into three temporal sections: Pre-arrest, intra-, and postoperative arrest. The discussion in each period includes (1) a brief introduction, (2) the structural aspects To institutional response (staff, training and equipment), (3) follow the steps for early identification, concentrate on CPR and early defibrillation and (4) procedural questions related to the care provided and quality improvement measures (real-time feedback, automated equipment that may replace the staff and provide similar response , the withdrawal of life support therapy).[14]

During the resuscitation, the return of spontaneous circulation indicates the need to interrupt the maneuvers. For patients who delay or do not return by spontaneous circulation, the decision to continue or terminate cardiopulmonary resuscitation is more difficult, mainly because of the lack of standardized measures for such situations. This decision has association with time and response to resuscitation maneuvers.[15]

The duration of the CPA is a condition that affects the outcome. Long periods of cardiopulmonary resuscitation are associated with higher mortality. Literature data have shown that the duration of the CPA exceeding 10 minutes is predictive of significant decrease in survival until the discharge.[16]

Evidences suggest that the prolonged resuscitation is associated with a decrease of survival probability.[17-20] Situation found in this study. Studies show that the younger age and female gender are associated with longer duration of resuscitation and absence of return of spontaneous circulation. However, the association of gender with the result of the CPA is conflicting [21-3] in this study, male gender showed a tendency to evolve with greater CPA time than the females. On the other hand the young (age less than 60 years) presented greater time of cardiopulmonary resuscitation (p=0.006), confirming the reality shown. The perception of the professionals in relation to the possibility of a better response in the young patient, may influence in the investment time of the resuscitation.[15]

Certainly, the tachycardia or ventricular fibrillation, is associated with a greater probability of survival than other CPA rates.[24] In this study, the patients in pulseless electrical activity (PEA) evolved with higher percentage of death in relation to the asystole and ventricular fibrillation rates.[15] The impact of cardiac rhythm in the success of the PCR is statistically significant (p<0.001). Despite the improved survival rate is documented in rhythms such as ventricular fibrillation and tachycardia, asystole may be reversible if there is a correctable cause, such as bleeding or cardiac tamponade. Therefore, the enhanced monitoring, the immediate beginning of the efforts of resuscitation and the presence of qualified personnel with training in advanced cardiac life support (ACLS) can provide a better clinical evolution of the patient, regardless of the initial CPA heart rate.[25]

The underlying disease may act as a confounding factor in a CPA. This is frequent in the elderly, by accumulating a higher number of comorbidities.[26] Adrenaline should be the drug of choice for care to CPA.[1] Employment of adrenaline contributes significantly to the return of spontaneous circulation, with favorable neurological function.[27] In this study the use of this product occurred in half of the assistances for CPA, giving way to noradrenaline, a potent α-adrenergic drug almost devoid of ß-adrenergic properties, which can be an interesting alternative to adrenaline. It can improve organ perfusion during cardiopulmonary resuscitation and can be more efficient than adrenaline in ventricular fibrillation cases.[28]

A recent study has confirmed that the existence of a permanent education on life support maneuvers, physiotherapists and nurses become effective medical care for CPA.[29] As in this study, this shows the relevance of the combination of knowledge as a fundamental tool in the prevention of avoidable deaths.

CONCLUSION

Cardiopulmonary arrest was determined predominantly by the pulseless electrical activity (PEA) rate.

Younger patients had a longer cardiopulmonary arrest time.

The predominant outcome was death, especially among the patients that presented s PEA rate.

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REFERENCES

1. American Heart Association (AHA). Destaques das Diretrizes da American Heart

Association 2010 para RCP e ACE [Internet]. 2010 [cited 2015 Jan 11]. Available from: http://guidelines.ecc.org/guidelines-highlights.html

2. Tortolani DA, Risucci RJ, Rosati R, Dixon. In-hospital cardiopulmonary resuscitation: patient, arrest and resuscitation factors associated with survival. Resuscitation [Internet]. 1990 [cited 2015 Jan 11];20(2):115–28. Available from: http://www.ncbi.nlm.nih.gov/pubmed/2174183

3. Weston CFM, Jones SD, Wilson RJ. Outcome of out-of-hospital cardiorespiratory arrest in south Glamorgan. Resuscitation [Internet]. 1997 [cited 2015 Jan 11];34(3):227–33. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9178383

4. Timerman S, Gonzalez M. Rumo ao consenso internacional de ressuscitação cardiopulmonar e cuidados cardiovasculares de emergência 2010 da Aliança Internacional dos Comitês de Ressuscitação. Rev Bras Clin [Internet]. 2010 [cited 2015 Jan 11];8(3):228–37. Available from: http://files.bvs.br/upload/S/1679-1010/2010/v8n3/a009.pdf

5. Agarwal, DA, Hess EP, Atkinson EJ, White RD. Ventricular fibrillation in Rochester, Minnesota: experience over 18 years. Resuscitation [Internet]. 2009 [cited 2015 Jan 11];80:1253–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19716220

6. Weidman EK, Bell G, Walsh D, Small S, Edelson DP. Assessing the impact of immersive simulation on clinical performance during actual in-hospital cardiac arrest with CPR-sensing technology: A randomized feasibility study. Resuscitation [Internet]. Elsevier Ireland Ltd, 2010 [cited 2015 Jan 11];81(11):1556–61. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20724057

7. Yeung J, Meeks R, Edelson D, Gao F, Soar J, Perkins GD. The use of CPR feedback/prompt devices during training and CPR performance: A systematic review. Resuscitation [Internet]. 2009 [cited 2015 Jan 11];80(7):743-51. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19477574

8. Canova JCM, Cyrillo RMZ, Hayashida M, Pompeo DA, Mendonça RCHR, Dalri MCB. Parada cardiorrespiratória e ressuscitação cardiopulmonar: vivências da equipe de enfermagem sob o olhar da técnica do incidente crítico. J Nurs UFPE on line [Internet]. 2015 [cited 2015 Jan 11]; 9(3):7095-103. Available from http://www.revista.ufpe.br/revistaenfermagem/index.php/revista/article/view/7234

9. Wayne DB, Didwania A, Feinglass J, Fudala MJ, Barsuk JH, McGaghie WC. Simulation-based education improves quality of care during cardiac arrest team responses at an academic teaching hospital: A case-control study. Chest [Internet]. 2008;133(1):56–61. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17573509

10. Chan PS, Jain R, Nallmothu BK, Berg RA, Sasson C. Rapid response teams: a systematic review and meta-analysis. Arch Intern Med [Internet]. 2010 [cited 2015 Jan 11];170:18-26. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20065195

11. Rozenbaum EA, Shenkman L. Predicting outcome of inhospital cardiopulmonary resuscitation. Crit Care Med [Internet]. 1988;16:583–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/3371021

12. Zanini J, Nascimento ERP do, Barra DCC. Parada e reanimação cardiorrespiratória: conhecimentos da equipe de enfermagem em Unidade de Terapia Intensiva. Rev Bras Ter Intensiva [Internet]. 2006 [cited 2015 Jan 11];18(2):143–7. Available from http://www.scielo.br/pdf/rbti/v18n2/a07v18n2.pdf

13. Jacobs I, Nadkarni V, Bahr J, Berg R a., Billi JE, Bossaert L, et al. Cardiac arrest and cardiopulmonary resuscitation outcome reports: Update and simplification of the Utstein templates for resuscitation registries. A statement for healthcare professionals from a task force of the International Liaison Committee on Resuscitation. Circulation [Internet]. 2004 [cited 2015 Jan 11];110(21):3385–97. Available from: http://www.ncbi.nlm.nih.gov/pubmed/15557386

14. Morrison LJ, Neumar RW, Zimmerman JL, Link MS, Newby LK, McMullan PW, et al. Strategies for improving survival after in-hospital cardiac arrest in the United States: 2013 consensus recommendations: A consensus statement from the American heart association. Circulation [Internet]. 2013 [cited 2015 Jan 11];127(14):1538–63. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23479672

15. Khan AM, Kirkpatrick JN, Yang L, Groeneveld PW, Nadkarni VM, Merchant RM. Age, Sex, and Hospital Factors Are Associated

With the Duration of Cardiopulmonary Resuscitation in Hospitalized Patients Who Do Not Experience Sustained Return of Spontaneous Circulation. J Am Heart Assoc [Internet]. 2014 [cited 2015 Jan 11];3(6):e001044-e001044. Available from: http://jaha.ahajournals.org/content/3/6/e001044.abstract

16. Rafati H, Saghafi A, Saghafinia M, Panahi F, Hoseinpour M. Survival after in-hospital cardiopulmonary resuscitation in a major referral center during 2001-2008. Iran J Med Sci [Internet]. 2011 [cited 2015 Jan 11];36(1):50-3. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3559123/

17. Ballew KA, Philbrick JT, Caven DE SJ. Predictors of survival following in-hospital cardiopulmonary resuscitation. Arch Intern Med. 1994 [cited 2015 Jan 11];154(0):2426-32. Available from: http://www.ncbi.nlm.nih.gov/pubmed/7979838

18. Bedell SE, Delbanco TL, Cook EF EF. Survival after cardiopulmonary resuscitation in the hospital. N Engl J Med [Internet]. 1983 [cited 2015 Jan 11];309:569-76. Available from: http://www.ncbi.nlm.nih.gov/pubmed/6877286

19. Schultz SC, Cullinane DC, Pasquale MD, Magnant C, Evans SRT. Predicting in-hospital mortality during cardiopulmonary resuscitation. Resuscitation [Internet]. 1996 [cited 2015 Jan 11];33(1):13-7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/8959768

20. Shih CL, Lu TC, Jerng JS, Lin CC, Liu YP, Chen WJ, et al. A web-based Utstein style registry system of in-hospital cardiopulmonary resuscitation in Taiwan. Resuscitation. 2007 [cited 2015 Jan 11];72(3):394-403. Available from http://www.ncbi.nlm.nih.gov/pubmed/17161519

21. Topjian AA, Localio AR, Berg RA, Alessandrini EA, Meaney PA, Pepe PE, et al. Women of Child-Bearing Age Have Better In-Hospital Cardiac Arrest Survival Outcomes than Equal Aged Men. Crit Care Med [Internet]. 2010 [cited 2015 Jan 11];38(5):1254-60. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20228684

22. Herlitz J, Rundqvist S, Bång a., Aune S, Lundström G. Is there a difference between women and men in characteristics and outcome after in hospital cardiac arrest? Resuscitation [Internet]. 2001 [cited 2015 Jan 11];49(1):15-23. Available from http://www.ncbi.nlm.nih.gov/pubmed/11334687

23. Fugate JE, Brinjikji W, Mandrekar JN, Cloft HJ, White RD, Wijdicks EF, et al. Post-Cardiac Arrest Mortality Is Declining A Study of the US National Inpatient Sample 2001 to 2009. Circulation [Internet]. 2012 [cited 2015 Jan 11];126(5):546-50. Available from http://www.ncbi.nlm.nih.gov/pubmed/22740113

24. Meaney PA, Nadkarni VM, Kern KB, Indik JH, Halperin HR, Berg RA. Rhythms and outcomes of adult in-hospital cardiac arrest. Crit Care Med [Internet]. 2010 [cited 2015 Jan 11];38(1):101-8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19770741

25. Tobi KU, Amadasun FE. Cardio-pulmonary resuscitation in the intensive care unit: An experience from a tertiary hospital in Sub-Saharan Africa. Niger Med J [Internet]. 2015 [cited 2015 Jan 11];56(2):132-7. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4382604/

26. Gomes, AMCG, Timerman A, Souza CAM, Mendes CMC, Filho HPP, Oliveira AM et al. Fatores prognósticos de sobrevida pós-reanimação cardiorrespiratória cerebral em hospital geral. Arq Bras Cardiol [Internet]. 2005 [cited 2015 Jan 11];85(4):262-71. Available from http://www.scielo.br/pdf/abc/v85n4/a06v85n4.pdf

27. Hagihara A, Abe T. Prehospital epinephrine use and survival among patients with out-of-hospital cardiac arrest. JAMA [Internet]. 2012 [cited 2015 Jan 11];307(11):1161-8. Available from http://www.ncbi.nlm.nih.gov/pubmed/22436956

28. Mion G, Rousseau JM, Selcer D, Samama CM. Cardiac arrest: should we consider norepinephrine instead of epinephrine? Am J Emerg Med [Internet]. Elsevier Inc [Internet]. 2014 [cited 2015 Jan 11];32(12):1560.e1-1560.e2. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24997106

29. Gilligan P, Bhatarcharjee C, Knight G, Smith M, Hegarty D, Shenton A, et al. To lead or not to lead? Prospective controlled study of emergency nurses' provision of advanced life support team leadership. Emerg Med J [Internet]. 2005 [cited 2015 Jan 11];22(9):628-32. Available from:

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