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CONTENTS

Geographic Information System (GIS) for Dengue Research in Indonesia: A Review

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ABSTRACT

Introduction: Geographic information system (GIS) can be very effective tool in combating dengue infection. However, there is only few study that apply GIS in dengue research in Indonesia
Objectives: The purpose of this literature review is to identify how geographic information system (GIS) applications have been used in dengue mapping in Indonesia and to critically examine the issues, strengths, weakness and challenges inherent to those approaches, especially from the spatial analysis and public health point of view.
Methods: The research articles in English or Indonesian were taken by online only using Google Scholar search engine. Only articles that addressed GIS methodology or dengue–related GIS applications were selected for this review. These articles must contain the combination three words including Geographic Information System (GIS), dengue and Indonesia in its titles or abstracts.
Results: Through the review process, conducted in October 2013, it is evident that the applications of GIS in dengue research can be generally categorized into four issues including dengue risk mapping and surveillance (n = 5), combined remote sensing-GIS (n = 4) web application (n = 2), and climatic and other associated factor with dengue (n = 3). This review explores how GIS approaches have been used to analyze the correlation of dengue incidences with environmental risk factor. GIS also used as a tool to improve dengue surveillance and outbreak management. This review also revealed the lack of GIS techniques using in Indonesian dengue research.
Conclusion: GIS-related methodological techniques and tools can be meaning fully applied in dengue research and management.

Keywords: Geographic Information System (GIS), dengue, Indonesia

INTISARI

Pendahuluan: Sistem informasi geografis (Geographic Information System/GIS) dapat menjadi alat yang sangat efektif dalam menanggulangi infeksi dengue. Namun, hanya sedikit yang menggunakan GIS dalam penelitian dengue di Indonesia
Tujuan: Tujuan dari tinjauan pustaka ini adalah untuk mengidentifikasi bagaimana aplikasi sistem informasi geografis (GIS) telah digunakan dalam pemetaan dengue di Indonesia dan untuk memeriksa secara kritis isu-isu, kekuatan, kelemahan dan tantangan yang terjadi akibat pendekatan-pendekatan tersebut, terutama dari pandangan analisis spasial dan kesehatan masyarakat.

Metode: Artikel penelitian dalam bahasa Inggris atau Indonesia diambil secara online hanya menggunakan mesin pencari *Google Scholar*. Hanya artikel yang membahas metodologi GIS atau aplikasi GIS yang terkait dengan dengue dipilih untuk artikel review. Artikel-artikel ini harus memiliki kombinasi tiga kata yaitu Sistem Informasi Geografis (GIS), demam berdarah dan Indonesia dalam judul atau abstrak.
Hasil: Melalui proses review yang dilakukan pada bulan Oktober 2013, aplikasi GIS dalam penelitian dengue secara umum dapat dikategorikan ke dalam empat hal yaitu pemetaan risiko dan pengawasan dengue (n = 5), kombinasi penginderaan jauh-GIS (n = 4), aplikasi web (n = 2), dan iklim dan faktor lain yang terkait dengan dengue (n = 3). Artikel review ini mengeksplorasi bagaimana pendekatan GIS digunakan untuk menganalisis hubungan insiden DBD dengan faktor risiko lingkungan. GIS juga digunakan sebagai alat untuk meningkatkan survailans dengue dan manajemen wabah. Artikel ini juga mengungkapkan kurangnya penggunaan teknik GIS dalam penelitian dengue Indonesia.
Simpulan: Teknik dan alat metodologis yang terkait dengan GIS dapat sepenuhnya diterapkan dalam penelitian dan manajemen dengue.

Kata Kunci: Sistem Informasi Geografis (GIS), demam berdarah, Indonesia, review

INTRODUCTION

Dengue infection (both of dengue fever/DF and dengue hemoragic fever/DHF) is a significant and emerging health problem in Indonesia and other tropical countries. Dengue fever and the more lethal dengue hemorrhagic fever are mosquito-borne diseases[1]. They are caused by flavivirus that is transmitted by infected *Aedes* mosquitoes[1]. Two fifths of the world's populations are at risk. Dengue vectors can breed in any small amount of water such as vases, flower pots, discarded containers, or used tires[2].

As a vector borne disease, dengue infection depends on environment factor[1]. So it becomes importance to study the disease and other related factor to help health officer make decisions to reduce the incidence and severity of its outbreaks.

Geography and studies of human health and well-being have a long history[3]. A classic example of the value of a geographically orientated in health studies is John Snow's study of mapping the outbreak of cholera in London in the mid-19th century that revealed a clustering around a water pump[3]. GIS or Geographic Information System is a geographic tool that can be applied to gain insight into the relationships between health outcomes and social, demographic, economic, and ecological variables[4].

GIS can be used to complement conventional ecological monitoring and modeling techniques, and provide means to portray complex relationships in the ecology of disease[5]. In addition, the use of GIS to identify environmental features allows determination of risk factors and delimitation of areas at risk, permitting more rational allocation of resources for cost-effective control. Since 1996, GIS have been used in our territorial cross-sectional and longitudinal parasitological surveys in order to experiment new applications to plan sampling protocols and to display quickly, clearly, and analytically the spatial and/or temporal distribution of parasitological data[5].

In theory, GIS can be an effective tool in combating dengue infection, however, in

practice there are many challenges to its successful use in Indonesia. The focus of this review is to provide some balance discussion about using GIS in dengue research in Indonesia. A review of this type is needed because much of the literature in this area is written by health or geography researcher only, without collaborate each other. The purpose of this paper is to identify how GIS applications have been used in dengue research in Indonesia and to critically examine the issues, strengths, weakness and challenges inherent to those approaches, especially from the spatial analysis and public health point of view. This paper is not to suggest that GIS technology should be used or not be used in dengue research, but to provide some balance by discussing the strength and limitations of GIS in Indonesian context.

Materials and Methods

Searching strategies and databases searched

This review consisted of a search of online published literature in the English and Indonesian language. Databases were searched using keywords contained in the title, abstract, or descriptor terms. The research article was taken by online only using Google Scholar search engine. The search was restricted to studies reported in English or Indonesian-language journals or reports or other publication and indexed with the keyword strategy outlined in *Table 1*. Databases that were searched included journal web, university database and government office. References within identified articles were reviewed for further studies.

Table 1. Set search terms used in this review

Set Search Terms
• 001 GIS OR Geographic Information System* AND Dengue
• 002 #1 AND Indonesia
• 003 GIS OR Geographic Information System* AND DemamBerdarah
• 004 SIG OR SistemInformasiGeografis* AND DemamBerdarah
• 005 SIG OR SistemInformasiGeografis* AND Dengue
• 006 GIS OR Geographic Information System* AND Disease AND Indonesia
• 007 GIS OR Geographic Information System* AND health application
• 008 #7 AND Indonesia

Inclusion/exclusion criteria

Only articles that addressed GIS methodology or dengue–related GIS applications were selected for this review. Each included study had to have: 1) primary research, not article; 2) research that conducted in Indonesia; 3) GIS as a measurement and/or analysis tool and/or application; 4) at least one variable related to the dengue or its vector. The search and review process conducted in October 2013

Systematic review process

The numbers of references searched from Google Scholar database. After reviewing and removing duplicates, references were found of

which 31 were identified following the screening of titles and abstracts. Ultimately, 13 published studies were included in this review.

RESULTS AND DISCUSSION

There were 8 articles in Indonesian language and 5 article in English that contain the combination of three words i.e. Geographic Information System (GIS), dengue and Indonesia in its titles or abstracts. These articles were organized into categories based on the main type of application reported including *dengue risk mapping and surveillance (n = 5), combined remote sensing-GIS (n = 4) web application (n = 2), and climatic and other associated factor with dengue (n = 3).* One article organized into 2 categories because contains two type application of GIS[6].

DENGUE RISK AREA MAPPING

There are 5 research using GIS to model dengue risk area. All of them used scoring and overlay. They scored environmental factor and overlay this into dengue incidences map. High risk area represent by high score.

The environment parameter always used in their research were population density, land use, drainage condition, settlement pattern[6,7,8,9]. Another parameter was dengue incidences/ reporting cases. Additional parameter was used by Sumunar[6], Widiyani[7], and Widiantoro[8]. Widiyani[7] explored about the condition and cleaning water vessel activity related to dengue incidences. Community waste collecting pattern as dengue risk factor parameter was also used in this study. The other additional parameter used Sumunar[6] was rainfall. Different approach was taken by Widiantoro[8], by using larva and protective factor parameter to developed dengue risk area map.

Despite almost all research in this categories focused on dengue risk area mapping, Apiadsa[9] moved forward by using GIS- dengue risk area map to assisted dengue outbreak management in Magelang. Perdana[10] also have different approach by exploring how GIS can help dengue surveyor officer.

COMBINED GIS-REMOTE SENSING DENGUE MAPPING

There are 4 researches using combined GIS-remote sensing technique to study dengue-environment correlation. The 3 researches used satellite image and one research used airplane image (foto udara). Apiadsa[9] and Ruliansyah[11] shown how Quickbird, a very high resolution satellite image can be used as environmental data in GIS-dengue mapping. Kiang[2] using ARIMA to model the dengue cases in Jakarta, Indonesia using TRMM (Tropical Rainfall Monitoring Mission) data and dew point temperature. TRMM is low resolution satellite image. In other hand, Sumunar[6] used airplane image as a data source of her GIS-dengue mapping. Integration of remote sensing imagery and GIS used to analyze physical environmental risk factors associated with dengue such as land use, altitude, rainfall, settlement and mosquito flying area[2]. The research showed that remote sensing image is useful technique to determine physical environment factor related to dengue

WEB APPLICATION OF GIS-DENGUE MAPPING

There are only 2 researches on Web application of GIS in dengue research. Hidayatullah[12] developed a simple web GIS–dengue risk area in Tegalrejo, Yogya. A simple information map model not only for health officer but also for residences in that area was proposed. Kusnanto[13] developed a Web-based integrated DHF surveillance in Sleman. This model has made to assist dengue surveillance by health officer.

CLIMATIC AND OTHER FACTOR ASSOCIATED WITH DENGUE

There are only 3 researches in this category. Two research used GIS methodology to correlation between dengue and climatic factor[14,15]. Astutik[14] shown the correlation between DHF incidences and rainfall in East Java Province. She also offered 3 model spatio-temporal correlations between DHF incidences and rainfall. Bangs et al. [15] shown that an ENSO-driven increase in ambient temperature had a marked influence on increased dengue virus transmission by the vector population. He also explored the associations of entomological and climatic effects that precipitated the epidemic before the influx of reported human cases.

Nagao[16] used GIS to determine geography factor of socio economic that affect DHF Patient in Surabaya He also found that age and socio economic factor affect the mosquito abundance are the most important determinant of the mean age of DHF's patient

There are two interrelated components of disease–GIS research. First is disease mapping and the second is disease modeling. Disease mapping is used to understand the geographical distribution and spread of disease in the past or present[17,18]. Disease modeling extends the disease-mapping application to (a) predict the future spread of disease, (b) identify factors that may foster or inhibit disease transmission, (c) pinpoint high-risk areas for disease prevention or intervention, (d) target control efforts, (e) identify gaps, and (f) increase stimulus for data collection in these areas [17,18].

Many factors are known to contribute to dengue transmission, including environmental conditions, socioeconomic status, and meteorological conditions. Among these factors, meteorological and environmental factors are perhaps the most noticeable. For example, dengue transmission may increase with the arrival or the end of a rainy season, and lack of sanitation settlement[2]. Temperature, humidity and rainfall are the important environmental determinants for dengue transmission[2]. However, there are only few research in Indonesia focused in this area.

There is only one research on dengue mapping process by a geographer[10]. Most of the researcher studied GIS-dengue mapping is public health expert or post graduate students so they only studied by plotting incidence to area map. This is the most basic application and involves mapping the incidence/prevalence of dengue over some geographic area[2]. The focus is on examining past trends as well as the present situation and typically does not include any statistical analysis with the possible exception of correlating dengue incidence/prevalence with population in order to calculate populations at risk. The purpose of these studies is to see the patterns of disease[2]. GIS overlay technique were used in almost all research, but only 2 researches used additional technique (buffering and clustering)[6,11].

There are only 2 researches studied on mapping of relationships between dengue incidence/prevalence and other related variables[14,15]. The timeframe is still on past trends and the present situation. The goal of these studies is to see if any relationships exist between dengue incidence/prevalence and a host of other variables including temperature[14,15], rainfall[14,15], land use/land cover[6,7,8,11], breeding sites[8,15] and control programs[9]. In most cases these studies involve testing to see if any statistical relationships exist.

Astutik[14] has shown a different approach by using complex statistical method modelling, but very difficult to be implemented by health officer in the field. This literature is future-oriented and focuses on predicting areas of dengue risk. Risk models typically use many of the same variables discussed above, but the difference being that statistical relationships are established between dengue incidence/prevalence (the dependent variables) and a range of independent variables in an effort to predict future cases of dengue

Because data collection is one of the major limitations of using GIS, innovative ways of collecting data are critical to the success of GIS. For the most part, this literature deals with remote sensing in the form of aerial photography[7] and satellite imagery[2,11]

The lack of GIS- dengue research in Indonesia showed they are many challenges in GIS- dengue research development. The challenges in using GIS for dengue research can be organized in three parts[2,5]. The first relates to basic data. Without adequate data, GIS is not very useful. The problems include accurate data on the disease and how it is reported, basic environmental data on land uses, topography, rainfall and demographic data of people. The second relates to technology – specifically computer hardware, GIS software, human resources and training. Based on these data, the biggest problem is only few university have GIS related health expert. This is shown by the fact that 2 of 3 GIS-dengue researches were from Yogyakarta. The third area concerns in methodology development, how can GIS be used to improve our understanding of dengue? As noted, there is no standard methodology in spatial statistical analysis [2].

There are two potential research areas in GIS- dengue research in Indonesia. They are *Disease mapping,* especially in geodatabase, GIS assisted surveillance, limited resources GIS mapping and web disease mapping and *Disease modeling extends,* especially in spread of disease prediction, pinpoint high-risk areas for disease prevention or intervention, target control efforts, identifying gaps and simple model with limited resources.

CONCLUSION

This review explores how GIS approaches have been used to analyze the correlation of dengue incidences with environmental determinants. GIS also used as a tool to improve dengue surveillance and outbreak management. This review revealed the lack of GIS techniques using in Indonesian dengue research.

REFERENCES

1. Sutaryo. Dengue. First edition, Yogyakarta: Medika Universitas Gadjah Mada, 2004.
2. Kiang RK, Soebiyanto RP. Mapping the risks of malaria, dengue and influenza using satellite data. Proceeding of the International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XXXIX-B8, 2012.
3. Rinaldi L, Cascone C, Sibilio G, Musella V, Taddei R, Cringoli Geographical Information Systems and remote sensing technologies in parasitological epidemiology. Parasitologia. 2004 Juni;46(1-2):71-4.
4. Jerret M, Gale S, Kontgis C Spatial Modeling in Environmental and Public Health Research. International Journal of Environmental Research Public Health. Apr 2010; 7(4):1302-29.

5. Sipe NG, Dale P. Challenges in using geographic information systems (GIS) to understand and control malaria in Indonesia. Malaria Journal 2003; 2: 36.
6. Suryo Sumunar. Penginderaan jauh dan system informasi geografis untuk perkiraan kejadian luar biasa penyakit demam berdarah dengue di kota Yogyakarta, 2008.
7. Widayani P. Pemodelan spasial epidemiologi demam berdarah dengue menggunakan system informasi geografis di Kelurahan Terban Kecamatan Gondokusuman Kotamadya Yogyakarta (Tesis) Environment Science Universitas Gadjah Mada, 2004.
8. Widiyantoro Y, Studi epidemiologi dan analisis spasial kejadian demam berdarah dengue menggunakan system informasi geografis di Kecamatan Bajawa Kabupaten Ngada Nusa Tenggara Timur (Tesis) Environment Science Universitas Gadjah Mada, 2012.
9. Apiadsa A, Pemanfaatan citra Quick bird untuk pemodelan spasial prioritas penanganan kejadian luar biasa Demam Berdarah Dengue (KLB DBD) di kota Magelang. (Skripsi) Faculty of Geography Universitas Gadjah Mada.
10. Perdana A, The Use of GIS (Geodatabase) in Combating Dengue Fever in Indonesia Phase II Project (Study Site: The City of Yogyakarta). Proceeding of Map World Forum; 2009 Feb 13; HICC, Hyderabad India.
11. Ruliansyah A, Gunawan T, Pemanfaatan Citra Penginderaan jauh dan system Informasi geografis untuk pemetaan daerah rawan demam berdarah dengue (Studi Kasus di Kecamatan Pangandaran Kabupaten Ciamis, Provinsi Jawa Barat) (Tesis) Universitas Gadjah Mada, 2011.
12. Hidayatulloh AF, Mulyanto A, Ulfah M *Aplikasi Sistem Informasi Geografis untuk penanganan penyebaran demam berdarah (studi kasus Puskesmas Tegalrejo Yogyakarta (Skripsi) Fakultas Sains dan Teknologi UIN Sunan Kalijaga, 2011.*
13. Kusnanto H, Sunartono FA. Web-based integrated DHF surveillance system in Sleman district Yogyakarta Indonesia. [cited 2011 Nov 25]. Available from: URL: http:// www.amic.org. sg/ict/external/awar ds/ 0402A5L48_Interim_ Report1.pdf.
14. Astutik S, Rahayudi B, Iskandar A, Fitriani R. Bayesian Spatial-Temporal Autologistic Regression Model on Dengue Hemorrhagic Fever in East Java, Indonesia. Applied Mathematical Sciences, 2013;7(9).
15. Bangs MJ, Larasati RP, Corwin AL, Wuryadi S Climatic factors associated with epidemic dengue in Palembang, Indonesia: implications of short-term meteorological events on virus transmission. The Southeast Asian Journal of Tropical Medicine and Public Health, 2006;37(6).
16. Nagao Y, Rachmie EM, Padmidewi MM, Kuntarianto, Kawabata M. Geographical association between socioeconomics and age of dengue haemorrhagic fever patients in Surabaya, Indonesia.Dengue Bulletin, 2011;35.
17. Myers MF, Rogers DJ, Cox J, Flahault A, & Hay SI.Forecasting disease risk for increased epidemic preparedness in public health. In: Remote Sensing and Geographical Information Systems in Epidemiology (Advance Parasitology). Elsevier, 2000;47:309-30
18. Robinson TP. Spatial statistics and geographical information systems in epidemiology and public health In: Remote Sensing and Geographical Information Systems in Epidemiology (Advance Parasitology). Elsevier, 2000;47:81-128.

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..... it has been reported[1] .....

..... according to Sardjito[2] .....

..... Winstein & Swartz[3] conducted .....

..... by Avon *et al*.[4] .....

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Sample References

Scientific Journal

1. *Standard journal article*

   You CH, Lee KY, Chey RY, Menguy R. Electro-gastro-graphic study of patients with unexplained nausea, bloating and vomiting. Gastroenterology 1980; 79(2):311-14.

   Goate AM, Haynes AR, Owen MJ, Farral M, James LA, Lai LY, et al. Predisposing locus for Alzheimer's disease on chromosome 21. Lancet 1989;1:352-55.

2. *Organization as author*

   The Royal Marsden Hospital Bone-marrow Transplantation. Team. Failure of syngeneic bone-marrow graft without preconditioning in post-hepatitis marrow aplasia. Lancet 1977;2:742-44.

3. *No author given*

   Coffee drinking and cancer of the pancreas [editorial]. BMJ 1981;283-628.

4. *Article not in English*

   Massone L, Borghi S, Pestarino A, Piccini R, Gambini C. Localisations palmaires purpuriques de la dermatite herpetiforme. Ann Dermatol Venereol 1987;114:1545-47.

5. *Volume with supplement*

   Magni F, Rossoni G, Berti F, BN-52021 protects guinea-pig from heart anaphylaxis. Pharmacol Res Commun 1988;20 Suppl 5:75-78.

6. *Issue with supplement*

   Gardos G, Cole JO, Haskell D, Marby D, Paine SS, Moore P. The natural history of tardive dyskinesia. J Clin Psychopharmacol 1988;8(4 Suppl):31S-37S.

7. *Volume with part*

   Hanly C. Metaphysics and innateness: a psychoanalytic perspective.Int J Psychoanal 1988;69(Pt 3):389-99.

8. *Issue with part*

   Edwards L, Meyskens F, Levine N. Effect of oral isotretinoin on dysplastic nevi. J Am Acad Dermatol 1989;20(2 Pt 1):257-60.

9. *Issue with no volume*
   Baumeister AA. Origins and control of stereotyped movements. Monogr Am Assoc Ment Defic 1978; (3):353-84.
10. *No issue or volume*
    Danoek K. Skiing in and through the history of medicine. Nord Midicinhist Arsb 1982;86-100.
11. *Pagination in roman numerals*
    Ronne Y. Ansvarfall. Bloodtransfusion till fel patients. Vard-facket 1989;13:XXVI-XXVII.
12. *Type of article indicated as needed*
    Spargo PM, Manners JM, DDAVP and open heart surgery [letter]. Anaesthesia 1989;44: 363-64.
    Fuhrman SA, Joiner KA. Binding of the third component of complement C3 by Toxoplasma gondii [abstract]. Clin Res 1987; 35:475A.
13. *Article containing retraction*
    Shishido A. Retraction notice: Effect of platinum compounds on murine lymphocyte mitogenesis [Retraction of Alsabti EA, Ghalib ON, Salem MH. In: Jpn J Med Sci Biol 1979; 32:53-65). Jpn J Med Sci Biol 1980;33:235-37.
14. *Article retracted*
    Alsabti EA, Ghalib ON, Salem Mh. Effect of platinum compounds on murine lymphocyte mitogenesis [Retracted by Shishido A. In: Jpn J Med Sci Biol 1980;33:235-7]. Jpn J Med Sci Biol 1979;32:53-65.
15. *Article containing comment*
    Piccoli A, Bossatti A. Early steroid therapy in IgA neuropathy: still open question [comment]. Nephron 1989;51:289-91.
16. *Article in comment*
    Kobayashi Y, Fujii K, Hiki Y, Tateno S, Kurokawa A, Kamiyama M. Steroid therapy in IgA nephropathy: a retrospective study in heavy proteinuric cases [see comments]. Nephron 1988;48:12-7. Comment in: Nephron 1989;51:289-91.
17. *Article with published erratum*
    Schofield A. The CAGE questionnaire and psychological health [published erratum appears in Br J Addict 1989;84:701]. Br J Addict 1988;83:761-64.

Books and Other Monographs

18. *Personal author(s)*
    Colson JH, Armour WJ. Sports injuries and their treatment. 2nd rev. ed. London: S. Paul, 1986.
19. *Editor(s) as author*
    Diener HC, Wilkinson M, editors. Drug-induced headache. New York: Springer-Verlag, 1988.
20. *Organization(s) as author*
    Virginia Law Foundation. The medical and legal implications of AIDS. Charlottesville: The Foundation, 1987.
21. *Chapter in a book*
    Winstein L, Swartz MN. Pathologic properties of invading microorganisms. In: Sodeman WA Jr, Sodeman WA, editors. Pathologic Physiology, mechanisms of disease. Philadelphia: Saunders, 1974:457-72.
22. *Conference proceedings*
    Vivian VL, editor. Child abuse and neglect: a medical community response. Proceedings of the First AMA National Conference or Child Abuse and Neglect; 1984 Ma 30-31; Chicago. Chicago: American Medical Association, 1985.
23. *Conference paper*
    Harley NH. Comparing radon daughter dosimetric and risk models. In:Gammage RB, Kaye SV, editors. Indoor air and human health. Proceedings of the Seventh Life Sciences Symposium; 1984 Oct 29-31; Knoxville (TN). Chelsea (MI):Lewis, 1985:69-78
24. *Scientific or technical report*
    Akutsu T. Total heart replacement device. Bethesda (MD): National Institutes of Health. National Heart and Lung Institute; 1974 Apr. Report No.:NIH-NIHI-69-2185-4.
    Disertasi Youssef NM. School adjustment of children with congenital heart disease [dissertation]. Pittsburg (PA): Univ. of Pittsburg, 1988.

25. *Dissertation*
    Kay JG. Intracellular cytokine trafficking and phagocytosis in macrophages [Dissertation]. St Lucia, Qld: University of Queensland; 2007.
26. *Patent*
    Harred JF, Knight AR, McIntyre JS, inventors. Dow Chemical Company, assignee. Epoxidation process. US patent 3,654,317, 1972 Apr 4.

Other Published Material

27. *Newspaper article*
    Resberger B, Specter B. CFCs may be destroyed by natural process. The Washington Post 1989 Aug 7;Sect. A:2(col. 5).
28. *Audiovisual material*
    AIDS epidemic: the physician's role [videorecording]. Cleveland (OH): Academy of Medicine of Cleveland, 1987.
29. *Computer program*
    Renal system [computer program]. MS-DOS version. Edwardsville (KS): Medi-Sim, 1988.
30. *Legal material*
    Toxic Substances Control Act: Hearing on S. 776 Before the Subcomm. on the Environment of the Senate Comm. on Commerce, 94th Cong., 1st Sess. 343(1975).
31. *Map*
    Scotland [topographic map]. Washington: National Geographic Society (US), 1981.
32. Dictionary or Encyclopaedia
    Ectasia. Dorland's illustrated medical dictionary. 27th ed. Philadelphia: Saunders, 1988: 527.
33. *Classic material*
    The Winter's Tale: act 5, scene I, lines 13-16. The complete works of William Shakespeare. London: Rex, 1973.
34. *In press*
    Lillywhite HB, Donald JA. Pulmonary blood flow regulation in an aquatic snake. Science. In press.

Electronic Material

35. *Journal articel in the internet*
    Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis [serial online] 1995 Jan-Mar [cited 1996 Jun 5];1(1):[24 screens]. Available from: URL: http://www.cdc.gov/ncidod/EID/eid.htm
36. *Monograph in electronic format*
    CDI, clinical dermatology illustrated [monograph on CD-ROM]. Reeves JRT, Maibach H. CMEA Multimedia Group, producers. 2nd ed. Version 2.0 San Diego: CMEA; 1995.
37. Computer program
    Hemodynamics III: the ups and downs of hemodynamics [computer program]. Version 2.2. Orlando (FL): Computerized Educational System; 1993.

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