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Research Paper

The Use of Disability Adjusted Life Years in Estimating the Burden of Brucellosis in Kuku Dairy Scheme, Sudan

Health Economics

KEYWORDS : DALYs; Brucellosis; The burden of disease; kuku Dairy Scheme

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ABSTRACT

Disability adjusted life years (DALYs) were used as a measure to evaluate the impact of the morbidity caused by brucellosis. The use of such non- monetary index has the advantage of avoiding the potentially ethically or morally troublesome task of having to place a monetary value on human health and life. DALYs calculations were based on the fact that brucellosis is a non fatal disease. So the YLL part of DALYs goes to zero. Brucellosis was not included in the world disability weight tables so the estimate of 0.2 disability weight was based on Roth et al., (2003). The healthy years lost by a person as a result of Brucellosis in Kuku Scheme that accounted 7.5 DALYS. The study confirmed the endimicity of brucellosis in the scheme and the non monetary burden of producers' health was estimated.

INTRODUCTION

The burden of disease is an indicator for any health outcome that affects social welfare (Murray, 1994). It is a major element in the decision-making process; its quantitative assessment helps in providing a rational basis for research, implementation and policy development (Kay et al., 2000). The use of time as a unit of measure provides a simple and intuitive method to combine the time lived with a disability with the time lost due to premature mortality (Murray, 2000). Disability adjusted life years (DALYs) are a non –monetary economic measure of disease, they measure the loss from living a shorter life with disease (Meltzeret et al., 1998). DALYs were developed by the World Bank and the World Health Organization (WHO) to estimate the burden of disease across the world (Fox-Rushby, 2002). The disability weights are derived through the person trade-off (Murray and Acharya, 1997). According to Fox-Rushby (2002) they are intended to influence decision making in health systems.

DALYs for a disease or health condition are calculated by summing the years of life lost due to premature mortality (YLL) in the population and the equivalent 'healthy' years lost due to disability for incident cases of the health condition (YLD):

DALYs = YLL + YLD (Mathers et al., 1999).

As accounted by Murray et al., (1994)

$$YLL = \frac{K\,Ce^{ra}}{(r+\beta)^2}\{e^{-(r+\beta)(L+a)}\{-(r+\beta)(L+a)-1\} - e-(r+\beta)^a\{-(r+\beta)a-1\}\} + \frac{1-K}{r}(1-e^{-rL})$$

Where:

a = age of death (years).

r = discount rate (usually 3%).

β = age weighting constant (e.g. β = 0.04).

K = age weighting modulation constant (e.g. K= 1).

C = adjusting constant for age-weights (e.g. C= 0.1658).

L = standard life expectancy at age of death (years).

The YLD formula:

$$YLD= DW\{\frac{KCera}{(r+\beta)^2}\{e^{-(r+\beta)(L+a)}\{-(r+\beta)(L-a)-1\}-e^{-(r+\beta)a}\{-(r+\beta)a-1\}\}+\frac{1-K}{r}(1-e^{-rL})\}$$

Where:

a =age of death (years).

r = discount rate (usually 3%).

B, K, C = (constants).

L = duration of disability.

DW= disability weight.

Brucellosis is a worldwide re-emerging zoonotic disease (Pappas et al., 2006). Nine Brucella species are currently recognized, of which seven affect terrestrial animals (Scholz et al., 2008; Scholz et al., 2010; Seleem, et al., 2010)]. Five out of them infect humans, these are B. melitensis, B. suis, B. abortus and B. canis (Acha, and Szyfres, 2003). Humans acquire the infection by direct contact with infected animals, particularly aborted foetuses or by consuming unpasteurized animal milk (Dean et al., 2012a). In humans brucellosis s clinically manifested by undulant fever, malaise, insomnia, anorexia, headache, arthralgia, constipation, sexual impotence, nervousness and depression (Megid et al., 2010). The disease gains special importance as a significant public health hazard (Abeer, et al., 2003) and is one among most economically animal diseases in the developing countries (Bernues et al., 1997 and Dijkhuizen et al., 1995).

There are about 500,000 new human cases of brucellosis reported annually worldwide (Seleem, et al., 2010). A brucellosis disability weighting of 0.2 has been previously proposed for Disability-Adjusted Life Years (DALYs) calculation, based on the pain and impaired productivity known to result from infection (Roth, et al. ,2003) .Based on disability weights from the 2004 Global Burden of Disease Study, a disability weight of 0.150 is proposed as the first informed estimate for chronic, localized brucellosis and 0.190 for acute brucellosis (Dean et al., 2012b).

METHODOLOGY

The study area

The study was conducted in Kuku Scheme the most famous Dairy Scheme in Sudan. It located in Eastern Nile locality, Khartoum State east to the Blue Nile bank. The Scheme was established in November 1963 and covers an area of about 2600 acre (El Hadari and Simpson, 1967). The objectives of the scheme were to settle semi-nomadic animal owners in an irrigated land and to supply Khartoum with pasturalized milk (Nagat, 1982). The whole project was established by American aid and was the responsibility of the department of animal resources in the ministry of Agriculture (Mohammed, 1994).

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Data collection:
A sample of 176 volunteers including 4 females out of 649 in contact people were tested and investigated for brucellosis. Blood samples were collected and transferred to the National Health Laboratory for serological tests. The serum samples were screened by Rose Bengal Plate Test according to (Alton et al., 1975) and confirmed by c-ELISA as described by the producing company (Svanova Biotech- Uppsala- Sweden).

Data analysis
According to infection rate the disability adjusted life years (DALYs) were calculated. The YLL (years lost as result of premature death) part of DALY's formula was omitted because the disease is not fatal. The years of life with disability (YLDs) is calculated as follows.

$$YLD = DW\{ \frac{KCe^{ra}\{e^{-(r+\beta)(L+a)}\{-(r+\beta)(L-a)-1\}-e}{(r+\beta)^{2-(r+\beta)a}\{-(r+\beta)a-1\}\}+\frac{1-K}{r}(1-e^{-L})\}$$

Given:

a = Average age at onset of the disease (years) = 37 years (field data)

r = discount rate (usually 3%).

β = age weighting constant (e.g. β =0.04).

K = age weighting modulation constant (e.g. K= 1).

C = adjusting constant for age-weights (e.g. C= 0.1658).

L = average duration of the disease = 3 years

DW = disability weigh = 0.2(Roth et al, 2003).

The data was analysed using WHO reference DALYs calculating template (WHO,2014).

RESULTS AND DISCUSSION
According to the screening test out of the 28 persons reacted positive, these were further subjected to confirmatory test using c-Elisa where 20 reacted positive to c-Elisa.

Based of clinical signs and c-Elisa result, four people out of 176 (2.3%) were found to be actively infected. They complained from Fever, headache, arthralgia, night sweat, fatigue. As brucellosis is not a fatal disease the YLL part of the equation was omitted. Accordingly every infected person will lose one (1) year as a result of the infection and the studied population lost 7.5 years of their healthy life. Although it was not diagnosed before, this result confirmed the endimicity of human brucellosis in the scheme and estimated its burden among the studied population. Malta fever was usually diagnosed and treated as malaria or typhoid.

Table- 1 The burden of human brucellosis in Kuku Dairy Scheme in DALYs

Age	Persons		
	Population	DALYs	DALYs per 176
0-4	0	-	-
5-14	0	-	-
15-29	117	-	-
30-44	50	1	26.4
45-59	9	-	-
60-69	0	-	-
70-79	0	-	-
80+	0	-	-
Total	176	1	7.5

CONCLUSION
It was concluded that in Kuku scheme public health efforts regarding zoonosis need to be realized. A part from directly reduce the producers" incomes, the disease have an indirect negative impact on the scheme economy through the healthy life years of the produces lost as a result.

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REFERENCE

Abeer, H.,Q.L., Shawkat, and Yasser Al-Tarazi, 2003, Epidemiology of ovine brucellosis in Awassi sheep in northern Jordan. Prev. Vet. Med., 60: 297-306 | . Acha, N. P. and Szyfres, B. (2003) Zoonoses and Communicable Diseases Common to Man and Animals, 3rd ed., vol. 1. Pan American Health Organization (PAHO),Washington, DC. | Alton, G.G , JonesLM, Pietz D.E., (1975). Serological Methods : In laboratory techniques in brucellosis, 2nd edition. WHO,Geneva pp: 64-124. | Bernues, A.E. Manrique and M.T. Maza 1997. Economic evaluation of bovine brucellosis and tuberculosis eradication in a mountain area of Spain . Pre. Vet. Med., 30: 137-149. Programme | Dean, Anna S.; Crump ,L.; Greter, H.; Schelling, E.and Zinsstag, J.(2012a). Global Burden of Human Brucellosis: A Systematic Review of Disease Frequency. PLoS Negl Trop Dis. Oct 2012; 6(10): e1865. Published online Oct 25, 2012. doi: 10.1371/journal.pntd.0001865 | PMCID: PMC3493380 | Dean AS, Crump L, Greter H, Hattendorf J, Schelling E, et al. (2012b). Clinical Manifestations of Human Brucellosis: A Systematic Review and Meta- Analysis. PLoS Negl Trop Dis 6(12): e1929. doi:10.1371/journal.pntd.0001929 | Dijkhuizen, A.A. Hurine R.B.M. and A.W. Jalvingh, (1995). Economic analysis of animal disease and their control. Prev. Vet. Med. 25: 135- 149. | El Hadari. A., and Simpson, M.C., (1967). The production and Marketing of Milk in Khartoum province :an economic study of traditional and modern methods. Research bulletin No.7. | Fox-Rushby, J. (2002). Disability adjusted life years (DALYs) for decision-making? An overview of the literature .Office of Health Economics, 12 Whitehall, London e-mail laulsford@ohe.org www.ohe.org) | Kay D, Prss A, Coral N C (2000), session on environmental burden of disease. ISEE .Buffalo, 23-24 August 2000World Health Organization, Geneva | Mathers, C., Vos H., Stevenson, H. (1999). Microbial Infections. 9th edition. Vol.2. pp: [829-53]. | Megid J., Mathias,L. A. and Robles, C. A. (2010). Clinical Manifestations of Brucellosis in Domestic Animals and Humans. The Open Veterinary Science Journal, 4, 119-126 | Meltzer, M., Rigau-Perez, J. G ., Clark, G. G. , Reiter, P. and Gubler, D. j. (1998). Using Disability – Adjusted Life years to assess the economic impact of dengue in Puerto Rico: 1984-1994.Am,J.Trop.Med.Hyg., 59(2) :p [265-271]. | Mohammed E.A, (1994) Marketing and Price policy Setting to expand the production of milk in the Gzira .Phd Thesis, Berlin 1994. | Murray JL, Lopez A.D & Jamison D.T,(1994) The global burden of disease in1990: Summary results, sensitivity analysis and future directions, Bulletin of World Health organization, 72(3): 495- 509]. | Murray, J.L., (2000). Quantifying the burden of disease: The basis for disability- adjusted life years. Health Econ.;9(4): 353-65. | Murray J.L., and Acharya K., (1997), Harvard Center for Population and Development Studies, 9 Bow St., Cambridge, MA 02138, USA | Nagat, M.H.,(1982). The prospects of Agricultural cooperation in the Sudan. A case of Khartoum Province. MSc thesis ,.University of Khartoum. | Pappas G, Papadimitriou P, Akritidis N, Christou L, Tsianos EV. The new global map of human brucellosis. Lancet Infect Dis. 2006;6:91–9. | DOI: 10.1016/S1473-3099(06)70382-6 | Roth F, Zinsstag J, Orkhon D, Chimid-Ochir G, Hutton G, et al. (2003) Human health benefits from livestock vaccination for brucellosis: case study. Bulletin of the World Health Organization 81: 867–876. | Seleem, M. N., Boyle, S. M. and Sriranganathan, N (2010) Brucellosis: Are-emerging zoonosis. Veterinary Microbiology 140: 392-398. Doi: 10.1016/j.vetmic. 2009.06.021. | Scholz, H. C., Hubalek, Z., Sedlacek, I., Vergnaud, G., Tomaso, H., Al Dahouk, S., Melzer, F., Kampfer, P., Neubauer, H., Cloeckaert, A., Maquart, M., Zygmunt, M.S., Whatmore, A.M., Falsen, E., Bahn, P., Gollner, C., Pfeffer, M., Huber, B., Busse, H. J. and Nockler, K. (2008) Brucella microti sp. nov., isolated from the common vole Microtus arvalis. Int. J. Syst. Evol. Microbiol. 58, 375–382 | Scholz, H. C., Nockler, K., Gollner, C., Bahn, P., Vergnaud, G., Tomaso, H., Al Dahouk, S., Kampfer P., Cloeckaert, A., Maquart, M., Zygmunt, M.S., Whatmore, A.M., Pfeffer, M., Huber, B., Busse, H. J. and De, B. K. (2010) Brucella inopinata sp. nov., isolated from a breast implant infection. Int J Syst Evol Microbiol, 60: 801-808. doi: ijs.0.011148-0. | Web Sites | http://www.google.com/url?url=http://www.who.int/healthinfo/bodreference-dalycalculationtemplate.xls&rct=j&frm=1&q=&esrc=s&sa=U&ei=VA7oU_veOcHJ0QXyn4GwAg&ved=0CBgQFjAB&sig2=l7CNXeAGOQHxaeTTs6nrHg&us accessed on August 2014. |