

# Assessment of the economic impact of aids at national and multi-national level : development of a scenario-analytic approach to support health-care policy

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## Chapter 10

### General Discussion and Main Conclusions

This chapter is partly based on book contributions:

JC Jager, MJ Postma, K Tolley, J Kennelly: **Assessment of the Socio-economic Impact of AIDS; from national towards multinational scenarios.** *In:* D Fitzsimons, V Hardy, K Tolley (Eds) *The Economic and Social Impact of AIDS in Europe.* London: Cassell 1995, pp 40-53.

MJ Postma, H Kornarou, V Pappazios, R Leidl, K Tolley, J Kyriopoulos, JC Jager for the European Research Team on AIDS Scenarios: **Hospital Care for Persons with AIDS in Greece and the Netherlands; assessment of current and future impact.** *In:* J Kyriopoulos (Ed) *AIDS Cost Analysis and Patient Classification* (in press).



## **10.1 The Objectives Revisited**

This thesis addresses the economic impact of HIV/AIDS in the Netherlands and the European Union (EU) as a whole. It provides descriptions of methods to link epidemiological modelling to economic information for scenario analysis on AIDS impacts. The chapters refer to different methodological and empirical estimation issues. First, methods to estimate parameter values for models of AIDS economic impact are treated (chapters 3 and 4) as indicated in one of the objectives of this thesis. Second, methodological aspects of linking population-dynamical and statistical epidemiological models and economic information are dealt with in chapters 4,5 and 7, with explicit consideration given to resource utilization and costs in different stages of the disease. Also, chapter 7 addresses quality criteria for economic impact studies attributing to the development of the Standardised Costing Framework for HIV/AIDS hospital care. For planning purposes, potential future trends in the epidemic have been translated into health-care resource needs and corresponding costs at the national (chapters 5 and 9) and EU-level (chapters 4, 8 and 9). Chapter 6 deals with a requested application of the AIDS-impact model for policy-making, estimating the impact of AIDS on life insurance. The comparability of AIDS impacts on hospital resource utilization in different countries and with other diseases is treated in chapter 9 and the Annex of this thesis. Some issues surpassing the level of an individual chapter are stressed in the current concluding chapter. These issues relate for example to checking resource-need projections for years that have yet gone by, broadening the hospital costing viewpoint to other health-care sectors, policy implications of the scenario work (at the national and EU-levels) and methodological aspects of linking epidemiological models and economic information (incidence-based versus prevalence-based impact calculus). This final chapter concludes with evaluating all the objectives in the same order as presented in chapter 1.

## **10.2 Disease-staging and Cost-standardization of HIV/AIDS**

Previously, doubts have been expressed about the quality of published estimates of the costs of HIV/AIDS hospital treatment and care produced for EU-countries [66,218]. The explicit use of a standardised framework for cost estimation would help improve the quality of methods in studies on resource utilization and costs and enhance the comparability of cost estimates produced. This maximises their usefulness for a range of research

and policy purposes at the local, national and multi-national levels. Within the Standardised Hospital Costing Framework (SHCF) features of good quality studies are defined and these have been applied to EU-studies on hospital costs. Features of good quality refer to representativeness, the possibility of disaggregation, producing homogeneous cost groups and adherence to elementary standards of cost-of-illness studies. The SHCF is not intended to be a prescriptive instrument. It is used retrospectively for reviewing existing cost studies and can be prospectively used for helping in the development and conduction of new cost studies. The framework represents a combination of good costing practice and technical standards for cost estimation. An important area with uncertainty about the best method to employ is the choice of the patient classification system for HIV/AIDS stages (for example, CDC-stages, CD4-cell counts, viral load, AIDS-defining diagnoses or stages derived from variation in health-care resource utilization) [346]. Whatever classification is used, if it is to be useful for prospective financing and projection of health care it should reflect severity of illness, as this has been found to be the major indicator of variation in health-care resource utilization [347].

Profiles on hospital inpatient days utilization during the AIDS-stage show that a major part of health-care resources are utilized in the terminal phase. This is an important finding with respect to the previous section in that hospital resource utilization and cost studies ought to be standardized according to the patient distribution over terminal and non-terminal phases. The empirical approach chosen differentiates two substages: the final half year of AIDS preceding death (*late* stage) and the foregoing period (*chronic* stage). As illustrated in this thesis, hospital inpatient days utilization and hospital costs in the late stage are several times those in the chronic stage. Next to the need for standardizing the patient population, chapter 7 convincingly shows the importance of disease-staging for providing valid future projections under a range of assumptions. In particular in the situation of HIV/AIDS with rapid medical developments and related improvements in survival, neglect of disease-staging is shown to overproject hospital bed needs and costs by almost 15% over a period of five years into the future. Of course, further improvements in projection might be attained by distinguishing more than two substages.

Obviously, this staging concept is also relevant for other diseases. As studies from the US showed, ppy health-care costs and hospital discharges in the last year of life amount to approximately seven times those in other stages of disease. Gathering comparable information and developing similar methodology on diseases such as respiratory disease, cardiovascular disease and cancer, is needed and could benefit policy decisions in these fields. For example, Koopmanschap *et al.* illustrated the importance of choosing an

appropriate disease-staging for constructing future scenarios on Dutch cancer costs [348]. They introduce three stages: an incidence phase, an intermediate phase and a last year. Their analysis shows that - under specific assumptions - a prevalence-based model neglecting disease-stages might overproject cancer costs in 2005 by up to 20%. Although the disease-stagings for cancer and HIV/AIDS are still rather crude in only accounting for the major dynamics in disease progression, the type of conclusions reached are rather similar: neglecting disease-staging might significantly misproject health-care resources and costs in future scenarios. Staging of disease for economic reasons can follow different strategies, depending on purpose, disease characteristic and data availability; they typically have to be developed, motivated and tested just as any other analytical concept in economic evaluation and costing.

### **10.3 Linking Epidemiology and Economics**

Results of epidemiological models and economic information can be linked prevalence-based or incidence-based to assess and project health-care resources and costs. Traditionally, health economic research uses two basic methods for expressing the economic impact of disease, labelled incidence-based and prevalence-based methods [40]. The first concerns accounting lifetime health-care resources to the year of incidence of disease (*see* chapters 7 and 9). The second method concerns an annualization of these lifetime health-care resources (*see* for example, chapters 5 and 8). To cover the full economic impact of a health-care intervention, it is necessary to analyse the lifetime consequences for resource needs incurred by a representative case. This incidence-based approach does however assume that the future health-care technologies will remain the same as in the analysis, and also extends all other assumptions up to the time until the last incident case has been dealt with. If the assumption of everything staying equal holds true for the period of analysis, and if the full economic impact is what is being referred to in a decision context (for example, in decisions on prevention investments/budgets), the incidence-based approach is the more appropriate one. If on the other hand, the budget impact of a health-care technology is the focus of analysis, and if this impact is expected to change with new treatment technologies, then the prevalence-based approach, applied over a well-defined period of analysis, will be more appropriate to support decisions on the economic side. With respect to the full economic impact both methods are myopic. On the short-term however, the incidence and prevalence-based approaches may differ

even when applied to the same epidemiologic data set. As an example, the recent introduction of Highly Active Antiretroviral Therapy (HAART) in HIV treatment may serve. On the short-term HAART seems to cause major improvements in health and related cuts in hospitalizations. As a consequence, prevalence-based assessment for budgetting purposes one or two years ahead indicates reductions in hospital budgets for HIV/AIDS care [349]. However, resource-intensive and costly late stages of HIV/AIDS are merely shifted a few years ahead and on a lifetime basis costs will rise, also because HAART is quite expensive. An incidence-based approach would typically show the latter development, whereas a prevalence-based approach might focus on the short-term cost reductions only. In consequence, implications drawn for health policy might differ depending on the approach and presentation used. Obviously, the framework for linking epidemiology and economics should encompass the possibility of using both types of assessments and projections. The developed framework in this thesis satisfies this condition. Finally and completing the developed framework, confidence intervals and sensitivity analyses have been elaborated for various aspects (for example, per person-year monetary costs of AIDS and the duration of stay in the AIDS-stage).

#### 10.4 Dutch Scenario Results

At the time we performed the Dutch AIDS scenario study (chapter 4) reliable national data on hospital resource utilization for the new disease HIV/AIDS were lacking [350]. During the 1990s the coding of HIV/AIDS hospital care has become integrated in the routine daily hospital administration [351]. Over 99% of Dutch hospitals contribute to the national hospital register of SIG Health Care Information (Utrecht). In 1993, hospital inpatient days for HIV/AIDS as *primary* diagnosis amounted to 20 600 for AIDS and 2300 for the pre-AIDS stages (codes 042 for AIDS, 043 for AIDS Related Complex and 044 for other HIV). The estimate for hospital inpatient days in 1993 amounts to 39 900 for AIDS and 5400 for the pre-AIDS stages (chapter 5). Using more recent information that possibly better reflects hospital practice in the 1990s, the figure for AIDS was updated to 30 100 in chapter 9. An important drawback for comparing the estimation and the registration involves the classification systems used, that do not entirely match. The estimates are based on the AIDS surveillance case definition, whereas the national registration applies the 9th revision of the International Classification of Diseases. Because the AIDS surveillance case definition includes slightly more disease complicati-

ons than code 042 of the Classification of Diseases does, there is probably a better match if an unknown part of the inpatient days in the national register with AIDS as additional diagnosis were included. The national figures for HIV/AIDS as any (primary or additional) diagnosis were 60 000, including 54 200 days for AIDS. The combined estimate of chapters 5 and 9 of 35 600 inpatient days is now inbetween the nationally registered figures for HIV/AIDS as primary and as any diagnosis. This suggests that the estimates are in line with the national hospital registration. In consequence, the extrapolation of results of individual Dutch hospital studies seems to provide valid results for the national level. Furthermore, this extrapolation methodology has a major advantage when applied to other countries and the EU as a whole (chapters 8 and 9). Many other European countries lack an accessible national hospital register and hospital impact must necessarily be based on individual hospital studies.

In order to provide an indication of the monetary costs that are involved with the figures on hospital care one can elaborate on Dutch estimates of the costs of a hospital inpatient day, a hospital outpatient hospital visit and a day-care hospital contact that are available for 1990 [35]. Since then these costs per contact have increased due to price increases of inputs in hospital care - for example, salaries and investments in new technologies - and to increases in the care-intensity of a hospital contact - for example, the number of procedures during an inpatient day or outpatient contact [352]. Corrected for price increases due to both factors the respective cost figures in 1995 ECUs are 328 (inpatient day) and 125 (outpatient contact; including day care)<sup>34</sup>. Multiplication with the respective number of days and contacts results in 13.9 million ECUs, corresponding to 0.18% of the 1995 national budget for hospital care. This figure roughly corresponds to what was projected in chapter 5 for AIDS-related inpatient and outpatient hospital care in 1995 in one of three scenarios presented.

Combining the statistical methodology elaborated in chapter 9 and the monetary cost estimates of table 5.2 enables the estimation of lifetime hospital costs. In chapter 7 this type of calculation was used to motivate the application of a staged instead of a non-staged model, here we estimate the lifetime costs *persé*. In the reference scenario, as defined in chapters 8 and 9 for the Netherlands, lifetime hospital costs amount to 43 850 ECUs (95%-confidence interval for an individual PWA: 2260 - 107 700 ECUs). This figure underestimates the total lifetime hospital costs per person for groups of HIV-

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<sup>34</sup> To transform the 1990 cost level to the 1995 level a nominal growth factor of 1.24 and a factor for intensity-of-care increases of 1.10 is used [352]. For the exchange of Dutch guilders (ƒ) into ECUs an exchange rate of 1 ECU equals ƒ2.12 is used.



infected persons who survive longer than 2 years in the AIDS stage. Lifetime pre-AIDS hospital costs can be derived straightforward from chapter 5 to amount 23 100 ECUs. In an overview on the economic impact of AIDS in Europe, Jager *et al.* [107] provided an extension of the Dutch scenarios on hospital impacts to other sectors of health care. For patients in the pre-AIDS stages they estimated costs per person-year (ppy) of 120 ECUs for the GP and 4 120 ECUs for early AZT-treatment (500 mg/day), during respectively 7 and 1 years in average. For PWAs these ppy costs amount to 280 ECUs for the GP, 605 ECUs for home care (district nurse), 615 ECUs for home help and 375 ECUs for the nursing home. Elaborating on the expected lifetime hospital costs, total lifetime health-care costs would be 75 700 ECUs. So, on total lifetime health-care costs the share of non-hospital costs is estimated to be relatively small with only 12%. In future projections of the total health-care costs it was however shown that the share of home care grows in all scenarios investigated. This is a consequence of epidemiological developments solely, and the Dutch government policy of substituting home care for hospital care might be expected to sharpen this trend. In order to adequately monitor developments in the costs of HIV/AIDS it is necessary to set up a patient-based monitoring system in home care that is analogous to the one already existing in the hospital sector.

### 10.5 Extension of EU-results on Hospital Care

For the EU-level this thesis focusses on the impact of the AIDS-stage on the hospital resource needs (chapter 8) and hospital costs (chapter 4). Tolley *et al.* [276] provide some details from a review of EU cost studies published between 1985-1995. It was possible to make comparisons of inpatient and outpatient costs and to a limited extent of day-care costs, by AIDS and pre-AIDS stages for a number of EU-countries [95,353,354]. This review enables the update of the EU cost figures in chapter 4 to reflect the 1999 monetary cost projection. For this purpose, costs have been transformed from original price year and local currency to 1993 ECUs, using country-specific health-care expenditure price indices and the latest available health-care-specific purchasing power parities [355]. Resulting hospital costs ppy in the period 1988-1992 are between 20-40 thousand ECUs for AIDS patients across a range of EU-countries. In combination with the various scenarios this range indicates total hospital costs in 1999 to vary between 1.1 and 3.4 billion ECUs, compared to the baseline level around 0.8 - 1.6 billion ECUs in 1993. If the upper limit were the actual figure, 1999 hospital costs would reflect over 1% of the

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current health-care expenditure of all EU-countries. One should realize though that these future projections don't include any trends in ppy hospital costs.

Whereas utilization has declined over time in the late eighties and early nineties in all studies and countries for which trend data are available, any changes in hospital costs ppy have been far less dramatic [62,65,153,285,286-288]. Possible explanations are that the intensity of care and unit costs of resources have increased and more expensive medications have been introduced. For example, the recent introduction of antiretroviral combination triple therapy involves relatively high costs of approximately 15 000 ECUs per year [356]. However, as a consequence of the new therapy, cuts in HIV/AIDS hospitalizations have been reported in Los Angeles, New York and France [357-359]. Another study shows that benefits of averted hospital care might even surpass the incremental costs associated to the new therapy [360]. The calculations in chapter 8 on hospital bed needs for the EU after widespread introduction of triple combination therapy indeed show that significant reductions in prevalence-based calculated bed needs might result. As mentioned, it can be assumed that the costly (late) AIDS-stage is merely postponed and not prevented, and lifetime hospital bed needs and costs per HIV-infected person increase.

Tolley *et al.* [276] indicate that hospital costs are between 2 thousand (asymptomatic HIV in the UK in the period 1987-1989) and 10 thousand (symptomatic HIV in Spain in 1990) ECUs ppy for pre-AIDS stage patients, corresponding to 5% and 40% of the corresponding AIDS figures. In particular, levels of ppy inpatient days are significantly lower for the pre-AIDS stages, whereas the outpatient hospital utilization levels for AIDS and pre-AIDS stages are quite similar. For example, in one French study outpatient visits equal in both stages at approximately seven ppy [281]. Jager *et al.* [107] extended the preliminary scenario results of chapter 4 to encompass some of the indirect costs as well. In particular, they focus on the potential years of life lost (PYLL) due AIDS deaths. PYLL provide a proxy of indirect costs of HIV/AIDS in the EU, as a monetary value of the life years lost has not been estimated. Using an annual incidence-based procedure, they estimated the number of PYLL at the end of the century to range between 203 800 and 520 500. As illustrated by a number of studies [144,361,362] and for some selected EU-countries, PYLL for AIDS has surpassed those due to other infectious diseases and is in the order of magnitude of those due to suicide and road accidents. Recently, a possible doubling of PYLL up to the year 2000 in the Netherlands compared to the 1990-level has been indicated by Jager *et al.* [111]. It is shown that PYLL due to AIDS approaches those of diabetes, several types of cancer and chronic respiratory disease.

## 10.6 Impact of Scenario Analysis on Health-care Policies

The scenario analysis for HIV/AIDS in the Netherlands influenced the development of health-care policies at the national and the international level. At the national level, the summary and recommendations of the Scenario Study [101] were passed through to the delegates of the Dutch Lower House to serve in the discussions on AIDS-policies in 1992 [363]. A specific request referred to an advise on the global cost-effectiveness of the national budget of 944 000 ECUs for campaigns and projects to prevent the further spread of HIV within the Dutch population [364]. Discounting the lifetime hospital costs per HIV-infected person at 5% per year for 14 years between infection and death, it may be argued, from an economic point of view, that such budget would start to be cost-effective if more than approximately 20 new infections would be prevented on an annual basis. This seems quite feasible. Moreover, if the indirect costs of HIV infection were taken into account, one could qualify the budget as cost-effective with even fewer new infections prevented required. Thus there was an economic argument in favour of the present prevention budget unless of course the budget could be spent on another disease prevention area that has a better cost-effectiveness ratio.

In chapter 6 the request for a study on the impact of AIDS on life insurance was discussed. Also, some economic analyses in HIV prevention and treatment drew on work performed in the Scenario Study. For example, cost-effectiveness of HIV combination-therapy after percutaneous exposures of Dutch medical personell was calculated at £20 300 - 88 600 net direct costs per life-year gained [365]. The study suggests a sharpening of indication to improve cost-effectiveness. Furthermore, in 1990 a study on the evaluation of HIV screening among pregnant women in Amsterdam was started. One of the goals of the study was to investigate the cost-benefit ratio [366]. Benefits were thought to occur through possibly preventing the birth of an HIV-infected child and associated health-care costs, if an HIV-infected pregnant woman decides to terminate pregnancy. Costing figures derived from the Scenario Study were used. At present, an evaluation study of HIV-screening is much more complex since several new factors have proven to affect both the vertical transmission probability and the costs, such as AZT/Zidovudine treatment during and after pregnancy, breast-feeding versus formula feeding and an elective ceasarian section. Furthermore, early detection of HIV-infection through screening and early uptake of antiretroviral treatment might also have beneficial effects on the progression of HIV in the mother. To cover these recent developments and insights a model has been developed and a first application to England has been elabora-

ted [367-370].

From the start of the Dutch Scenario Study, it was the objective to build a scenario analytic approach that could easily be extended to foreign situations [100]. Therefore, the methodology of the approach and the illustrative results for the Netherlands have often been highlighted at international conferences. Furthermore, the Dutch Scenario Team was involved in meetings of several working groups of the EU and the World Health Organization on the economic impact of AIDS [109,110,303,304,371]. National study groups from Greece, Spain and France were advised on scenario construction for their respective countries [274,372-374]. In addition, future projects on the costs of AIDS in France and Belgium were drawn up with explicit reference to our scenario methodology [374,375]. During 1993 the finalized Dutch Scenario Study and related publications were crucial for being assigned with the grant for multi-national AIDS scenarios (EU-grant PL941723 of DG XII). A preliminary version of chapter 8 of this thesis was integrated in the final report of another EU-project in DG V [95]. As illustrated in Chapter 9 of this thesis, the standardized scenario analytic approach enables international comparisons. So in consequence, a monitoring system of AIDS impacts in Europe has been developed that addresses the wide range of epidemiology, economic aspects and societal responses. The importance of such a system was stressed by the Council of Europe in 1992, in order to enable a proper timing of rapid reaction procedures to new emerging developments in the HIV/AIDS epidemic, treatments and care [376]. More recently, a similar argument was published *Vaccine* [377]. Finally, during the international AIDS Conference in Vancouver the need for standardized procedures on performing economic impact assessments to help health-care policy development was stressed [378].

The studies on AIDS scenario analysis in this thesis, provide an example of scenario analysis in infectious diseases. As infectious diseases exhibit their characteristic dynamics, extension of the "traditional" cost-of-illness approach is motivated in his thesis. This extended approach is labelled dynamic cost-of-illness assessment. Combining this approach with scenario analysis - where a set of different assumptions on core-parameters is investigated - provides the basis for cost-effectiveness analysis in infectious disease prevention and treatment [379]. Above, examples on cost-effectiveness analysis of HIV-screening in pregnant women and post-exposure HIV prophylaxis were mentioned. Examples of the extension of the approach to other infectious diseases refer to screening for *Chlamydia trachomatis* [380-382] and Influenza vaccination [383-385]. Scenario analysis has already been mentioned as an integral part of cost-effectiveness [31], and this

seems to be true in particular for infectious diseases. Other specific features of cost-effectiveness analysis in infectious diseases illustrated in this thesis refer to the linkage with a model for the spread of the disease and the importance of sound costing figures on lifetime and per person-year basis. Ultimately, this thesis seeks to attribute to the development of guidelines for cost-effectiveness in infectious diseases [386,387].

## **10.7 Main Conclusions**

Guidelines should be applied for the estimation of HIV/AIDS-related personal health-care costs, allowing valid comparisons between studies performed at different times and settings by different researchers. (objective 1; chapters 3 and 7)

In general, there is a need for a standardized approach to cost-of-illness studies to increase the comparability of studies. (objective 2; chapters 4 and 7)

The choice of an appropriate disease-staging averts structural biases in projections of hospital care and costs. (objective 3; chapters 5,7 and 8)

Estimates of the resources and costs of hospital care for HIV/AIDS can be used for planning at the national or multi-national level if a standardized/generic approach in epidemiological modelling, data-gathering and severity-staging is applied. (objective 4; chapters 3 and 4)

In the Netherlands, ppy hospital costs in the late stage of CDC IV are almost threefold those in the chronic CDC-IV stage. Lifetime costs from the time of HIV-infection onwards are estimated to amount 76 000 ECUs, hospital costs constitute almost 90% of this figure. (objective 5; chapters 5 and 9)

Studies in several EU-countries show that utilization of hospital inpatient days in the care-intensive late stage of AIDS is twice to tenfold that in the chronic stage. In most investigated countries total hospital contacts in the chronic stage are approximately half of those in the late stage. (objective 5; chapter 8)

Dutch scenarios demonstrate that approximately one quarter to a half percent of total

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hospital costs will be required for HIV/AIDS by the end of the century, a sizeable but probably manageable proportion. Cost projections in several scenarios indicate a range for AIDS hospital costs of 0.5 and 1.0% of total EU-expenditures on hospital care by the end of the century. (objective 6; chapters 3, 5 and 10).

Hospital bed needs for AIDS in the EU will amount to 0.5% to 0.65% of all hospital beds available in the EU. Sensitivity analysis shows that new combination triple therapy might lower the estimate for hospital beds by 20-30%. (objective 6; chapter 8)

Statistical confidence limits in combination with several scenarios on hospital bed needs for AIDS by the end of the century, indicate a range of 0.2% to 0.3% of currently available hospital beds in the Netherlands. (objective 6; chapters 5 and 9)

Projected hospital bed needs in the Netherlands for HIV/AIDS by the end of the century are limited compared to projections for coronary heart disease, stroke and diabetes. (objective 7; chapter 5 and annex)

Quantitative information on hospital care for AIDS indicates that it is organised differently in the various EU-countries, varying from high inpatient (France) or outpatient (Greece) involvements to a mixed organisation form (Netherlands). (objective 7; chapter 8)

Differences in AIDS care between two selected countries can be explained from differences in the respective health-care systems. (objective 8; chapter 9)

Scenario analysis on economic impacts of HIV/AIDS has influenced the development of health-care policies at the national - advise on life-insurance impact, planning and economic evaluation - and international level - advisory role in set-up of foreign AIDS scenario studies. (objective 9; chapter 6,9 and 10)

The dynamic cost-of-illness approach for HIV/AIDS can be applied to other infectious diseases and therefore merely serves as an illustration for analyses in, for example Influenza and *Chlamydia trachomatis*. (objective 10; chapter 10)

The scenario analytic approach can be integrated in HIV/AIDS cost-effectiveness analysis

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(objective 11; chapter 10)

In this thesis a dynamic cost-of-illness approach has been developed for HIV/AIDS. The approach esteems the importance of linking cost-of-illness with epidemiological modelling into future scenarios. Further, the relevance of disease staging in costing and scenario analysis has been demonstrated and deserves broad attention in the standardization of costing methods. Future research should be directed to the development of dynamic cost-effectiveness analysis of treatment and prevention for infectious diseases. This type of research is currently in progress in both national and international initiatives [388,389]