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Study Report: Health Economic Model for Employee Wellbeing Programme Ghana

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Disclaimer

Abbreviations

AVRL	Aqua Vitens Rand Limited
BM	biometric measures
BMI	body-mass-index
BoD	burden of disease
CBA	cost-benefit analysis
CBR	cost benefit ratio
CD	Communicable disease
CEA	cost-effectiveness analysis
CEPS	Customs Excise and Preventive Services
EA	economic analysis
EPH	Epidemiology and Public Health Department, Swiss TPH
EWP	Employee Wellbeing Programme
GCNet	Ghana Community Network Services Limited
GHS	New Ghana Cedis
GRA	Ghana Revenue Agencies
GWCL	Ghana Water Company Limited
HRA	Health risk assessment
HSEU	Health Systems and Economics Unit, SCIH
IEC	information, education, communication
IRS	Internal Revenue Service
NCD	Non-communicable disease
NHIS	National Health Insurance Scheme
PI	Principal Investigator
PPP	Public Private Partnership
RAGB	Revenue Authority Governing Board
ReCHT	Regional Coordination Unit for HIV and Tuberculosis[1]
ROI	Return on investment
SCIH	Swiss Centre for International Health, Swiss TPH
Swiss TPH	Swiss Tropical and Public Health Institute
VATS	Value Added Tax Service
WHP	Workplace health promotion programme
WPP	HIV & TB Workplace project - Ghana Revenue Agencies

Swiss TPH

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Executive Summary

The growing burden of disease faced by low-income countries due to the ever-present infectious diseases and the steadily growing prevalence of non-communicable diseases severely strains most public health services and causes enormous economic losses in addition to human suffering. This crisis has challenged non-healthcare sector players to become involved in order to stem the tide of losses. Particularly employers in the public and private sectors have been investing in the health and wellbeing of their employees as a way to dampen the productivity losses caused by this enormous burden of disease.

Tools for enabling these non-healthcare specialists to make informed, evidence-based investment decisions to safeguard and improve the health and well-being of their human resources and further to support the business case for these investments have so far been lacking.

The GIZ in Ghana commissioned this study to explore the profitability of existing employee wellbeing programmes in Ghana and to support the development of an economic model which translates the epidemiological profile of the employees into understandable measures of productivity losses and which enables cost-benefit analysis of interventions being considered to alleviate these losses.

The model succeeded in quantifying and prioritizing the most important causes of productivity losses due to morbidity and mortality. The main findings indicate that top five account for well over half of the losses:

Number	Top five causes of productivity losses	Percent %
1	Malaria	24.99%
2	Hypertension	12.42%
3	HIV/AIDS	7.34%
4	Skin diseases	5.87%
5	Obesity	5.65%
	Total	**56.27%**

Table 1: Top five causes of productivity losses, percentages of total.

The remaining top causes of productivity losses individually account for less than 5% of the total, which indicates that investments in interventions to alleviate them will need also to be modest in order to achieve a net benefit.

The **research hypothesis** of this study, that **there is a positive net benefit to be realised by employers within a viable (business) time-frame from investing in needs-based, best practice health and wellbeing interventions for its employees**, has been supported by the study results. These results indicate that, based on very conservative assumptions of productive work days lost, employers can recoup most or all of their annualized investment within each year, for many interventions.

Disease / Risk Factor	Intervention Type	Cost / Benefit Ratio	Net Benefit [GHS]
Malaria	MAL-1 : Insecticide-treated bed nets (ITN)	**0.8227**	**2'873.51**
	MAL-3 : Indoor residual spraying (IRS)	**1.1140**	**-1'846.49**
	Both MAL-1 and MAL-3	**1.3636**	**-8'367.44**
Non-acute diseases & risk factors	Health risk assessment (in-house)	**2.8585**	**-12'548.21**
	Health risk assessment (go to doctor)	**5.2579**	**-28'748.21**

Table 2: An example in summary form of the results of the CBA for suggested interventions.

Moreover, the economic model developed permits employers to "test" any interventions targeting any of a wide range of priority causes of morbidity and mortality affecting its human resources. The testing allows great flexibility to change inputs for variations of interventions in order to calculate cost benefit ratios and the net benefit for each.

1 Introduction

1.1 Statement of the problem

The double burden of infectious and non-communicable diseases is a serious problem in Ghana, as it is throughout sub-Saharan Africa and elsewhere, and has adverse effects on both the population in terms of morbidity and mortality and the economy in terms of rising health care costs and losses of productivity[2].

Infectious diseases such as malaria and tuberculosis (TB) are major causes of morbidity and mortality in Ghana. Most recent data report 3.2 million annual cases of malaria[3], with an estimated number of deaths of 23,500 annually[4]. The estimated prevalence rate of TB is 363 cases per 100.000 population and the number of new cases per year 202/100'000 population in 2008[4]. In 2007, the national prevalence of HIV in the adult population between 15 and 49 years was 1.9%[5], with an estimated number of HIV positive adults – with or without symptoms of AIDS - in Ghana of 260,000[4].

The morbidity and mortality from non-communicable diseases (NCD) such as cardiovascular disease and cancer, also places a huge burden on the country[2]. Cardiovascular disease and breast cancer (in woman between 15-59 years) are among the top ten contributors to mortality[4], and their disease burden is expected to increase over the coming decades[6].

In line with these developments, risk factors associated with these non-communicable diseases are very prevalent in Ghana. For example, hypertension has been shown to have a prevalence of 27.4% (among urban civil servants)[7] [8] and obesity 14.1% (in an urban population)[9].

Infectious and non-communicable diseases are together a huge burden for the healthcare system, society and economy. Particularly the HIV-infected often suffer from stigma and discrimination at workplaces, and within their families and communities. Private households' capacities to generate income are jeopardised, and their financial capital is being diverted to respond to diseases, especially as many households have no access to social protection.

Infectious and non-communicable diseases also severely affect private companies, which lose huge numbers of their skilled workforce to diseases, leading to high employee costs and lower profit margins. In order to curtail the rising employee related costs, private companies are applying measures to improve the health situation and the productivity of their workforce, which can be assumed to translate into increased profits and ultimately an enhancement of the national economy.

Broader but equally important factors related to the spread of infectious and non communicable diseases may be the lack of basic health and social protection, employees' unawareness of measures to prevent diseases as well as lack of access to adequate diagnosis and treatment facilities. Although the Government of Ghana in 2005 introduced a National Health Insurance Scheme (NHIS) for all Ghanaians, approximately one third of the population remained unregistered by mid-2010[10]. Education and sensitisation is needed for the NHIS to win the trust of most Ghanaians. Other social protection measures such as retirement packages, property, accident and life insurances are not very common. This calls for private measures complementing the initiatives taken by the government.

In order to overcome these constraints which all negatively impact on the health and productivity of employees, private and public companies have begun to implement so-called "Employee Wellbeing Programmes" which in most cases evolved out of HIV workplace programmes (WPP). Such workplace programmes addressing a broader spectrum of preventive and treatment measures beyond HIV/AIDS are already being implemented in the Ghana Community Network Services Limited (GCNet)[11] together with the Revenue Agencies

(RA) and for Aqua Vitens Rand Limited (AVRL) with the Ghana Water Company Limited (GWCL).

A further EWP has been implemented from mid-2010 among GIZ Ghana national staff members working at the GIZ Ghana HQ and for the many programmes being supported by GIZ in Ghana.

1.2 Purpose of study

The aim of the GIZ-supported project **Implementation of sustainable and comprehensive Employee Wellbeing Programme** is: Employees of GCNet, the GRA, the GWCL and the AVRL, their core families as well as members of their immediate communities have an improved access to health, social protection and financial counselling services as well as to education, prevention, treatment and care facilities that are related to infectious and non-communicable diseases.

The **general objective of the health-economic analysis (cost-benefit analysis: CBA)** was to compare costs and monetary benefits of offering different preventive and treatment packages within the Employee Wellbeing Programme from the **perspective of the employer**. The aim was to assess the economic value of these workplace health promotion programmes from the employers' perspective. To this aim, a model has been developed that can be used by the companies (that generally bear most of the costs, direct and indirect, of workers' illness) to evaluate the economic benefit of adopting such a programme. The results of the CBA and appropriate sensitivity analyses should provide insight into whether such a programme is worthwhile for the employer and how net benefits (or costs) vary according to a change of assumptions (e.g. with regard to the epidemiological situation), a change of the constituent parts of the package (or screening intervals) or a change of the target population (employees, their family members, and members of their immediate community).

1.3 Significance of the study

There is very little evidence, if any, of the net benefit to the employer of investments in employee health and wellbeing programmes in Ghana, specifically, and in Africa, in general. This study contributes to the meagre evidence[12] on the cost-effectiveness of employer investments in employee health and wellbeing interventions in the context of Ghana, sub-Saharan Africa, and low-to-middle income countries, while acknowledging the substantial methodological challenges involved.

The study also aimed to produce a user-friendly tool to aid employers in making the business case for investments in employee health and wellbeing. There is very little evidence of the use of needs-based models, based on the epidemiological profile of the worker population, to inform employer decision making for investments in employee wellbeing programmes. This study aimed to provide a tool which enables employers to estimate the financial burden of any particular illness or condition which may be expected to affect the employees' productivity and to help prioritise investments in interventions to address the most "expensive" illnesses (from an employer perspective) affecting the employee population.

2 Background

An Employee Wellbeing Programme (EWP) has been initiated in mid-2009 and implemented at GCNet and the Ghana Revenue Agencies (GRA), which are partial owners of GCNet. The EWP serves as an expansion to the recently ended HIV & TB Workplace project (WPP 2006-2009) for the GRA. The WPP was a Public-Private-Partnership (PPP) project with GCNet being the private donor. The employees of GCNet have been included in the EWP because of the highly successful WPP. The EWP aims at reaching out to approximately 38,000 persons, comprising:

- Employees of GCNet with staff strength of 80 and their core families (partner and maximum six children) of approximately 280.
- Employees of the Ghana Revenue Agencies comprising of the Customs Excise and Preventive Services (CEPS), Internal Revenue Service (IRS) and Value Added Tax Service (VATS) in the ten regions of Ghana with a staff strength of 7,700 and their core families of approximately 15,000.
- Members of the employees' immediate communities (approximately 15,000) comprising of at least 60% women.

Building on the experience made in other projects where Employee Wellbeing Programmes have been built around existing HIV workplace programmes, this PPP first focuses on the facilitation of access to prevention, testing and treatment facilities for HIV/AIDS and other infectious and non-communicable diseases. The immediate communities are involved in this first component. Gradually this component will be complemented by the facilitation of access to social protection and financial counselling for the employees and their families, which is innovative in so far as these components will create a more comprehensive understanding of health protection among the partners than has so far been done in more "classic" workplace programmes.

A second Employee Wellbeing Programme (EWP) has been initiated and implemented at the state-owned Ghanaian water agency GWCL which was restructured with the assistance of the World Bank in 2006. A tendering competition for the production and dispersion of drinking water in Ghana was won by AVRL, a joint venture owned by "Vitens BV", a Dutch publicly-owned utility company which holds 51% of AVRL´s shares and "Rand Water", a South African utility company with a 49% shareholding. AVRL therein assumes the responsibility of the water operator, while GWCL is the owner of all relevant assets with responsibility for investments. AVRL has grown to nearly 3,000 employees in 2011, among which 2,900 are Ghanaian. GWCL has 80 employees.

Using the same approach as for the GCNet and GRA EWP (expansion of the previously successful HIV & TB workplace programme, WPP where AVRL is the private donor and with the support of GIZ), AVRL and GWCL implemented in mid-2009 an Employment Wellbeing Programme reaching out to approximately 39,000 people, comprising of employees of AVRL and GWCL with staff strength of approximately 3,000 and their core families of approximately 9,000 and members of the employees´ immediate communities (approximately 27,000)

A further EWP has been implemented from mid-2010 among GIZ Ghana national staff members working at the GIZ Ghana HQ or for one of the many programmes being supported by GIZ in Ghana.

2.1 Results of literature review

2.1.1 Procedure description

A literature review was conducted to find relevant articles and other publications relating to employee wellbeing programmes from the online databases of PubMed(NLM), OvidSP(Medline), GBV, LISTA at EBSCO, Library of Congress, U Basel Bern, NEBIS and Web of Science(TS) using the EndNote X4© software and with the assistance of the Head Librarian at the Swiss TPH. The key search words included (among others) occupational health, employee health, workplace health, cost effectiveness, meta-studies, Ghana, Africa, international. 472 references from the period of 1984 to 2010 could be identified, which have been scanned on the basis of title and abstract to extract the most relevant studies for this economic modelling study. The 300 search results from the period 2000 to 2010 were given particular attention.

2.1.2 Little evidence from Africa

The search produced a wealth of studies reaching back into the 1970s in the USA, but very few studies from Africa. Zungu et al (2007) conducted an international review of 45 "high-quality" studies of workplace health promotion (WHP) programmes of which 41 were from USA, Europe and Australia. Interestingly one conclusion of this study was that most of these programmes tend to reach healthy workers in the best companies and the authors suggest that WHP will increase the inequality of health in the world.[12]

2.1.3 Workplace health promotion programmes are cost-effective

The reviewed literature suggests that there is sufficient evidence to conclude that well-designed workplace health promotion programmes are generally effective and cost-effective. Pelletier (2009) has systematically reviewed studies of workplace health programmes in the USA which have been published in peer-reviewed journals and his seventh up-date adds 16 new studies from 2004 - 2008[13]. He concludes that the vast majority of the 153 studies reviewed indicate positive clinical and cost outcomes.

2.1.4 Methodology vs. pragmatism

There is a very clear trade-off in studies of workplace health programmes between satisfying the needs of employers in making evidence-based investments in employee health and the expense and constraints of conducting rigorous research. Pelletier notes a trend away from true experimental designs and towards companies conducting focussed or non-experimental demonstration disease management programmes on areas that are of specific importance to the employer. He suggests that these innovative studies can be the precursors of more rigorous research. Pelletier also quoted a report of the WHO European Working Group on Health Promotion Evaluation, WHO 1998 which noted that "the use of randomized control trials to evaluate health promotion initiatives is, in most cases, inappropriate, misleading and unnecessarily expensive." [13]

2.1.5 Measures of productivity losses

Baiker et al (2010) conducted a systematic review of peer-reviewed studies in the USA which satisfied criteria of having a well-defined intervention and well-defined treatment and comparison groups, even if these were not strictly randomly assigned. Their sample of 32 studies looked at either reduction in **health care costs** of employees or **absent days** or

both. All but one study showed a positive return on investment in terms of reductions in health care costs, absent days or both. [14]

There is much discussion about how to measure and cost the employee health-related "problem" and the benefits and the value of these benefits to the employer of interventions intended to address that problem. Most studies have limited these measures to those factors which are relatively easily measured, such as health care costs and sick days.

2.1.6 Presenteesim: base of the iceberg?

Another element of productivity losses, namely presenteeism has become more and more interesting to employers for the reason (among others) that absenteeism tends to disappear when there is general economic pressure. Employees tend not to risk taking sick days, which may be used as a criterion for deciding which employees are the least productive and should be laid off first.[15] Presenteeism has been defined in many ways, but Chapman (2005) suggested the following practical definition: "The measurable extent to which health symptoms, conditions and diseases adversely affect the work productivity of individuals who choose to remain at work."[16]

Estimates from numerous studies indicate that presenteeism may account for an additional loss of productivity ranging from 25% -750% of the time lost due to sick days.[17] [18]

2.1.7 Best-practice elements of workplace health promotion programmes:

The debate is recently focussing around which interventions and packages of interventions should be provided. There are several published articles which describe the elements common to successful workplace health promotion programmes. Goetzel and Pronk (2010)[19] summarised from a series of benchmarking and best-practice studies the following promising features of such programmes as 1) organizational commitment; 2) incentives for employees to participate; 3) effective screening and triage; 4) state of the art theory- and evidence-based interventions; 5) effective implementation; and 6) ongoing programme evaluation. They added that O'Donnell et al (1997) considered executive management support, employee input when developing goals and objectives, and a wide variety of programme offerings contributed to programme success.[20]

An additional aspect of this debate is a clear shift from workplace programmes focussing on providing treatment of specific diseases or conditions towards addressing the reduction of risk factors in more preventive approaches to employee health and well-being. Goetzel et al (2009) shows that "research with employers has documented the relationship between health risk status and important work-related cost and productivity outcomes and this research suggests that risk reduction among workers may be a practical way to improve these outcomes."[21] This brings the field of workplace health promotion programmes more in line with the global debate on health and well-being.

2.1.8 Epidemiological profile for Ghana

A **second search** was conducted to collect data for the epidemiological profile for Ghana. The resources of the WHO, the Global Burden of Disease reports, the Ghana Health Service[22], the Ghanaian National Health Insurance Scheme and some disease-specific studies for Ghana were tapped in order, as far as possible, to establish an age-sex disaggregated profile outlining the top causes of mortality and morbidity for formally employed, urban employees in Ghana which best match the target employee populations of the WPP/EWP. Data in consideration of key risk factors has also been gleaned from these sources. The available data were in many cases lacking for this specific population and it was necessary to make assumptions and triangulate the data from several sources to

achieve a reasonable estimation of the burden of disease expected for this population of employees.

The resources available online from WHO-Choice[23] provide(d) key information regarding best-practice cost-effective interventions, both preventive and curative for the most relevant diseases and conditions for the study population.

3 Methodology

3.1 Purpose of research and research hypotheses

The general objective of this economic analysis (cost-benefit analysis: CBA) is to compare costs and monetary benefits of offering different preventive and treatment packages within the Employee Wellbeing Programme from the **perspective of the employer**. To this aim, a framework has been developed that can be used by the companies (that generally bear most of the costs, direct and indirect, of workers' illness) to estimate the cost to the employer arising from the major illnesses and conditions affecting the employees and to estimate the potential benefits of investing in interventions to address these conditions and illnesses as elements of an employee wellbeing programme. The results of applying the economic model and sensitivity analysis should provide insight into whether such investments in EWP elements are worthwhile for the employer and how net benefits (or costs) may vary according to a change of assumptions (e.g. with regard to the epidemiological situation), a change of the constituent parts of the package (or screening intervals) or a change of the target population (employees, their family members, and members of their immediate community).

Research Hypothesis:

There is a positive net benefit to be realised by employers within a viable (business) time-frame from investing in best practice health and wellbeing interventions for its employees.

3.2 Population

The target population for this study consists of the employees of the agencies and companies described more fully in preceding chapters of this report. The epidemiological profile for this population has been estimated by adjusting appropriately the national epidemiological profile for the entire Ghanaian population. Such factors have been taken into account as: 1) the mostly urban setting of the employees, 2) the employees are formally employed, 3) the nature of their work is mostly white-collar, office-based with some exceptions, such as the many officers of the Customs Excise and Preventive Services working at the mostly rural outposts at the national borders and the employees of the AVRL who are responsible for service and maintenance work of the (urban) water supply system.

As this study is based partly on historical data for the entire workforce and forecasts the costs of health problems and the benefits and costs of the interventions in employee health and wellbeing based on an economic model, there is no sampling and also there are no control groups. It is a recommended further step to conduct a longer-term prospective study to establish the accuracy of the forecasts from the model and also to establish the actual costs and achieved benefits from the interventions undertaken.

This study has also excluded the family and community members of the employees targeted by the WPP/EWP as most interventions of these programmes focussed on the employees themselves, with the exception of awareness-building actions which also targeted the families and members of the wider community.

3.3 Instrumentation (include copy in appendix)

3.3.1 Description of Model (Excel tool)

The Excel tool implements the model algorithms used to calculated costs due to absence days and presenteeism based on the specific epidemiological profile and data related to disease treatment. It allows the user to specify a set of input parameters such as data related to employees, disease-specific scaling factors and global settings.

It consists of several work sheets which are grouped into various categories related to user input, the display of model predictions, and tables of baseline data.

For more details and a user guide to the Excel tool please see Appendix 7.2

3.3.2 Model equations

For a description of the model equations and algorithms use please refer to Appendix 7.1

3.3.3 Survey tools and data collection from study target employers

As part of our mandate to develop a modelling tool to enable employers to calculate the cost of individual sources of productivity losses, it was necessary to concentrate on data which would be readily available to the employer, without needing to engage in a time-consuming, potentially expensive search for model input requirements.

This was the focus of data collection efforts from the target population employers based mostly in Accra with the intent of collecting the following historical data:

1 Annual staff strength, number of staff members each year disaggregated by sex

2 Annual total in new Ghana Cedis (GHS) for staff medical expenses

3 Annual number of medical claims for reimbursement made

4 Annual total in GHS of salaries expense

5 Annual total number of sick leave days disaggregated by sex

6 Annual number of staff turnovers due to illness, disability or death disaggregated by sex

7 Annual number of compassionate leave days

Table 3: Historical data requested from study target employers.

The survey tools prepared for this study and which were sent in advance of the data collection mission by the Principal Investigator (PI) were designed to collect these data from the employers of the EWPs from their human resources (employee) and financial records for as many years back as possible. The Excel-based survey tools were introduced to the employers by GIZ ReCHT officers responsible for the two EWPs included in the study. The employers responded through these officers that the tools were too detailed and not easily understood. They suggested a simplified version which was then agreed to be used.

The lead time of approximately three weeks before the mission of the PI sensitized the employers and the GIZ officers as to the extent of the information required for the study.

It was beneficial during the PI mission to Accra to engage the GIZ officers and the employer representatives in clarifying discussions of which information was needed and which information was possible to collect. For the GRA/GC-Net EWP, the PI was able to meet with each of the employers and the GIZ officer responsible at least once to clarify and agree on the information requirements and availability. For the GWCL/AVRL EWP, it was possible to

arrange a preliminary meeting with the GIZ officer and the employer representatives of the AVRL to clarify the data needs and availability also with regard to the GWCL.

During these meetings, **two goals** were being pursued:

1. collecting historical data which would facilitate an assessment of the costs and benefits of the previous HIV/AIDS WPP and the current EWP including the data mentioned above as well as the following:

	GIZ ReCHT EWP information		
8	Monitoring & Evaluation reports	14	EWP programme financial reports for programme expenses
9	Semi- and Annual reports	15	WPP dedicated staff costs
10	KAP GTZ study report	16	EWP dedicated staff costs
11	Baseline study 2008	17	Organisation charts current
12	HIV/TB study 2008	18	Organisation charts previous
13	WPP programme financial reports for programme expenses		

Table 4: Programmatic data requested from study target employers, GIZ ReCHT EWP.

and

2. collecting data and information which could be used to compare with the model estimates and help to refine these estimates.

Many discussions were held with employers and GIZ-ReCHT officers to explain the study procedures and goals and to understand more of the local conditions and qualitative elements of these WPP and EWP. These discussions were very fruitful for the PI in order to inform the model parameters and the need to base it on very minimal data inputs which would be reasonably easy to obtain and also to understand by the employers who are subsequently to use the model for needs-based decision-making in investing in appropriate interventions.

The data collection exercise began before the mission, but most data was collected subsequently over the many weeks following the mission. The PI engaged in an intense exchange with the employers through the GIZ officers to remind of requested information, to verify, correct, and complete data. After many weeks, it became apparent that some employers were not able to release any information required, notably the GWCL and the AVRL, and the GRA employers were forthcoming with much of the requested data, but in a piecemeal, incomplete way.

At the time of writing this study report, the data available was mostly insufficient to pursue the first goal (a historical CBA of the WPP and EWP), and only one data set, notably that of the VAT of the GRA, was complete enough to enable a useful comparison with the model estimates based on the same employee population inputs.

Please refer to table 13 in Appendix 7.3 for a summary table of data sets received.

3.4 Procedure

3.4.1 Step one: Establishing the employee epidemiological profile

Morbidity and mortality

The first step in this study was to determine the most important contributors to morbidity and mortality from the national health statistics available from the WHO, the Global Burden of Disease Programme and from the Ghana Health Services as far as available disaggregated by sex and age groups. This allowed finding the relevant incidence, prevalence and mortality rates which most closely match the target populations of the study, namely the beneficiaries of the WPP/EWP. Some of the data available from the WHO Global Burden of Disease reports were segregated sufficiently to extract the needed information for urban, adult populations by sex. Some of the data was not sufficiently segregated and needed to be calculated as far as possible from secondary reports from the GHS and from the NHIS operations manual from 2008[24], which provided additional detail from which it was possible to approximate the **relative incidence of the major causes of mortality and morbidity**.

These data were further disaggregated through calculations into approximate proportions of outpatient and inpatient incidence based on the data available in the NHIS operations manual mentioned above which provided outpatient incidence and also numbers of admissions for each disease listed.

It was possible to establish a relative ranking of the major causes of morbidity and mortality for an urban population, disaggregated by sex and also to approximate the relative proportion of inpatient and outpatient incidence for these same diseases.

Some of the classifications of diseases provided in GHS reports did not follow the standard classifications used by WHO and these needed to be re-allocated to the relevant WHO disease classifications in order to establish a final definitive list ranking the most relevant causes of morbidity and mortality for the Ghanaian urban adult population segregated by sex. The purpose here was not to significantly estimate the incidence of each particular disease in the urban adult population but to establish a list of the most influential causes of morbidity and mortality and to establish their relative importance in comparison to each other.

Risk Factors

The burden of disease statistics found for Ghana also reported the prevalence of several important risk factors, also disaggregated sufficiently to get an impression of the relative importance of these for an urban, adult population by sex. Some recent studies also focussed on a very comparable population of civil servants in Accra for hypertension and obesity. These are particularly interesting in relation to the discussion of the shift towards reducing these health risks as a more cost-effective way to improve the productivity of the employees as compared to interventions of a curative nature. [21]

The study from Goetzel et al 2009 estimated the presenteesim effects for various risk factors for a large population of Novartis employees in the USA, which showed the relative effect on worker productivity due to the presence of risk factors. These estimates were used in combination with the Ghana prevalence rates of health risk factors mentioned above to estimate productivity losses due to presenteeism among the employee populations in this study.

Mental illness?

There was a dearth of relevant statistics concerning mental health causes of morbidity and mortality in Ghana, which can be suggested to grossly underestimate their influence on the productivity of the target population, but were excluded from the model due to lack of verifiable relative prominence compared to somatic causes of morbidity and mortality.

3.4.2 Step two: estimate the average length of an episode of each illness

This step is key to this economic analysis in order to convert the burden of diseases established in step one from measures of morbidity and mortality into measures of work days lost per episode of each disease or condition.

YLD route

This was first attempted using the standard calculations published by Murray and Lopez (1996)[25] for determining, for each disease and WHO region, the YLDs (= Years Lived with Disability) comprising of the average intensity of an episode of disease (disability weight) multiplied by the average length of the disability measured in time. The average durations of an episode of illness were obtainable only for three diseases, namely malaria, upper respiratory tract infections and diarrhoeal diseases and these have been used in the economic model as an optional proxy indicator for estimating the average number of work days lost due to sickness (absenteeism and presenteeism) for a case of each of these illnesses.

For the other diseases and conditions, the available data was not available to use directly, as for the three mentioned above. Nor was it possible to calculate it using the standard formula, though the use of the DISMOD II software which has been developed for the Global Burden of Disease studies was recommended for this purpose. The lack of corresponding WHO Global Burden of Disease incidence rates needed to complete the calculations disease by disease frustrated the use of this seemingly promising tool to estimate the average durations of an episode of illness.

"Average length of stay in hospital" route

It was necessary to seek another solution, which we based on the Ghanaian National Health Insurance Scheme Tariff and Benefits Package Operation Manual 2008. This provided in its Annex B a list of the causes of hospital admissions with an average length of stay. The average durations of an outpatient episode of illness were assumed to be the same as the average length of stay in hospital for an in-patient case. These estimates are adjustable through a scaling factor to calculate the average number of sick days per outpatient case for the employees.

Annex B

Stay in Hospital - Top Twenty Causes of Morbidity

Disease	Average length of stay in hospital [days]	Comments	Reference
Malaria	3.2		A
Infection upper respiratory tract	3.6		A
Diarrhoeal diseases	3.4	Based on data for 'gastroenteritis'	A
Skin diseases	8.3		A
Hypertension	4.3		A
Home/occupational injuries	6.2		A
Acute eye infections	7.1		A
Pregnancy and related complications	3.8		A
Rheumatic and joint diseases	n.a.	No data available	A
Anaemia	4		A
Intestinal worms	4.7	Based on data for 'other disease digestive tract'	A
Gynaecological conditions	3.8	Based on data for 'complicated pregnancy'	A
Malaria in pregnancy	3.8	Based on data for 'complicated pregnancy'	A
Pneumonia	4.6		A
Acute ear infection	4.2		A
Typhoid fever	6.7		A
Road traffic injuries	4.6		A
Other oral conditions	3.1		A
Dental caries	n.a.	No data available	A
Diabetes Mellitus	8.1		A

Table 5: Stay in Hospital - Top Twenty Causes of Morbidity.

Outpatient or inpatient?

A further refinement in determining more accurately the lost productivity was possible based on the same NHIS operations manual which helped to establish the proportion of cases of each illness which were serious enough to require admitting the patient to a hospital (relative to outpatient cases listed in its Annex A).

Annex A

3.4.3 Step three: Estimate the burden of disease in terms of number and cost of work days lost for the target employee populations

Productivity losses measured in work days

There are five variables which combine to estimate the loss of productive days for each illness:

1. the outpatient average length of illness episode;

2. the work days lost due to presenteeism as an additional proportion of these sick days;
3. the lost productive days (presenteeism) due to the prevalence of health risk factors;
4. the additional days lost for those cases which would be admitted to hospital; and lastly
5. the very great loss of days caused for the very few expected cases of death of the employee. The estimated days lost in this case are based conservatively on the death benefits of salary for six months[26].

Treatment costs are history?

The estimation of the cost of treatment of these illnesses and conditions has recently become irrelevant, due to the obligation of all employees in the target populations to register with the NHIS and seek health care from the GHS. These services[27] are provided free of out-of-pocket fees in lieu of the monthly premium of 2.5% of the employees' salaries being deducted for the NHIS. Thus, the actual treatment costs which the employers were covering for services offered by NHIS as expenses up to and including 2010, have in 2011 become negligible.

There were also considerations of the employers providing a top-up insurance package for its employees to cover those items not covered by the NHIS or to be able to obtain the covered services from non-GHS sources in the private health care sector. These costs are also assumed to be fixed costs to the employer which are independent of and do not change according to the health care services the employees actually use. There may still be a very few cases in which the employers may be required to cover very high costs for treatment procedures not covered or fully covered by the insurance schemes provided, such as for planned heart surgery, etc. These have been assumed to be exceptional cases and have not been explicitly considered in this model.

Input employee numbers

The employer may enter the employee numbers by sex into the model, which then estimates the number of work days to be lost for the expected number of cases per disease and condition. These estimates will be shown for sick days (absenteeism due to sickness: outpatient and inpatient), death benefit days and also for those due to presenteeism as an additional proportion of the sick days, and presenteeism due to the presence of risk factors. Finally, the model shows a total number of productive days lost per disease or condition and calculates of the total number of productive days lost for the employee population.

These estimates made by the model in the base case have been calibrated and verified through triangulation against the historical data collected from the employers on sickness days (not available disaggregated by disease). Unfortunately, the quantity and also the quality of these data were less than optimal and can only give a very rough estimate of the historical annual total sick days. The only data set which was complete for this purpose were those of the VAT section of GRA, for the four years from 2007 - 2010, for an employee population of just over 1000.

Costing a day lost

Having, up to this point in the model, established a forecast of the number of days of lost productivity attributable to each disease and condition annually for the target population of employees, it is then possible to multiply this by a value of a work day based on a function of the total annual salary expense divided by the total number of employees to get an average annual salary per employee. This annual average salary is then divided by the number of working days available each year after deducting public holidays and annual leave. This figure has been estimated as a base figure of 217 days annually, but may be changed in the inputs to reflect the particular regulations of the employer using the model. Indeed, it is

possible for the model to be used for any sub-population of employees, whose real salary costs are known to obtain a more accurate estimate of the cost of the work days lost.

For alternative methods, please refer to Section 3.9 below.

Ranking the losses

The model calculates the annual "cost" of each illness and condition as a function of lost productive days and the average salary cost per work day. Based on this calculation, the model then provides a list ranking the diseases and conditions in terms of expected losses of productivity based on the salary cost of the expected days lost, firstly for each element: outpatient sick-days, inpatient sick-days, death benefits, presenteeism as an additional proportion of outpatient sick days and presenteesim based on the presence of risk factors and then finally as a total of all of these. This information already provides the employer with a very useful estimation of the most expensive sources of lost productivity relative to each other and of the potential cost savings to be gained by addressing investments according to these specific sources.

3.4.4 Step four: categorize and provide examples of best practice interventions for each major cause of "business" losses

The prioritized list of diseases, conditions and risk factors established in the previous steps of the model are then categorized according to the following logic. In analysing the list, it became evident that there were some limitations affecting the choice of interventions which an employer could undertake. With reference to the caveat concerning treatment costs outlined in step three above, it was possible to sort the list into three categories:

1. **Malaria** which has been estimated to account for about a quarter of the productivity losses.
2. **Non-acute diseases, conditions and risk factors** which are seen to account for about half of the productivity losses.
3. **Acute diseases and conditions** which have been suggested by the model to explain the remaining productivity losses.

Category 1 - Malaria

For malaria there are preventive interventions available which an employer may undertake as elements of an employee well-being programme. Based on WHO-CHOICE[23] information and other sources[28] [29] [30] a limited set of cost-effective best-practice **preventive** interventions for malaria has been included in the model as potential elements of an employee wellbeing package. These are listed along with their expected effectiveness in preventing incidence and mortality.

These interventions become even more attractive due to the possibility to externalize all or most of the costs which may be covered by global malaria initiatives. In this case, the inputs for the annualized cost per employee covered may be adjusted downward, resulting in correspondingly higher net benefits.

Category 2 - Non-acute diseases, conditions and risk factors

For this category, it is clear from the literature that it is in the interest and ability of the employer to offer any number of preventive interventions[20] in order to reduce the health risks which would lead to serious burden of disease for the employees if left unattended and to encourage diagnosis and treatment where needed.

The literature suggests that one of the first and necessary (but not sufficient) steps in any EWP is a health risk assessment[19]. It is therefore suggested here that this be promoted by the employer, in order, at least to encourage each employee to obtain regular health check-ups. This *should* result in reductions in the burden of disease of the employees by placing the employees into a doctor-patient relationship where all of the conditions *may* be diagnosed and treated. In this case, the effects are difficult to estimate even through actual observation, due to the variety of diseases and risks which may be affected and also due to the varying time-frames in which an effect may be observable.

It can be argued that treatment interventions should normally be considered within the framework of a doctor-patient relationship and not an employer-employee relationship. The threat of stigma faced at the workplace for people living with HIV, for example, illustrates the need for a confidential doctor-patient framework. That said, employer efforts to reduce discrimination at the workplace and in the communities could be considered here as an intervention in the model.

Many preventive interventions may be appropriate within the employer-employee framework. Preventive interventions such as Information, Education and Communication (IEC) and awareness-building actions for health or diseases, as well as promoting behaviour change, e.g. promoting healthy diet, exercise, stress management, smoking cessation, have not been explicitly included **as examples** in the model, as these are quite variable according to the context, type and scope and their effectiveness is often very difficult to estimate. For many preventive measures, the effects only become observable after several years of sustained implementation of an intervention.

Category 3 - Acute diseases and conditions

For these diseases and conditions, it is assumed that the employer can do little to influence prevention and treatment, aside from some occupational health interventions to prevent accidents at the workplace, for example. However, due to the acute nature of these conditions, it is further assumed that the employees will seek appropriate care as needed. Their cost-free access to GHS facilities for diagnosis and treatment due to obligatory enrolment in the NHIS supports this healthcare-seeking behaviour. The coverage by NHIF of most treatment costs relieves the employer of any significant role to play here. Therefore, there are no suggested interventions for possible inclusion in an EWP.

The model allows for user inputs of any preventive or curative interventions, both for individual conditions and risks for all three categories and also for the entire category two.

3.4.5 Step five: estimate the investment cost and the expected benefit for each intervention

For all interventions, the model allows the following inputs:

1. intervention name and description;
2. percentage of coverage of an intervention in terms of the number of employees to be targeted for the intervention;
3. intervention duration in years and annualized cost per year per employee;
4. effectiveness of the intervention in terms of annual percentage of cases and deaths prevented. These estimations may require a survey of the literature or consultation with a public health expert.

Based on these inputs, the model calculates the reduction in the burden of disease in terms of the value of saved work days, considering outpatient, inpatient and fatal cases prevented. The model then calculates a cost/benefit ratio as well as the net benefit: benefit less investment cost. These inform the employer of the relative effect of an intervention comparable to the others in the model and indeed to any other intervention where the CBR

has been calculated. All the interventions chosen or added to the model will be included in a summary table for ease of comparison.

3.4.6 Step six: communicate results, with recommendations to GIZ and employers, disseminate model to employers

3.5 Time frame

This study is based on an economic model and the time frame is assumed to be one year, but the model can be adapted to several months and years, according to the availability of data and need. The changing of the scaling factors for the epidemiological profile and the annual salary and work days can be used to adjust the model for different time frames. The inputs for interventions can also be adjusted accordingly. For the annualized cost and effect inputs for interventions it is implicitly assumed that future years will be discounted appropriately.

It is recommended to compliment this CBA study with a *prospective study* of at least one year duration (a multi-year study would be even more informative) which would enable a comparison of the model results against actual results in the contexts of the EWP target agencies and which would bring insights as to the robustness of the model and inform refinements, as well as provide evidence based on a more rigid research methodology. This would permit comparison of results in a wider context.

3.6 Analysis

Analysis has been conducted in two main areas: 1) the historical data collected from the employers and GIZ for the period covering the implementation of the WPP and the EWP and 2) the model estimates compared to historical data.

In the first area, the analysis was limited to plotting proxy indicators of productivity losses, namely annual statistics including absent days due to sickness, number and value of medical claims made, the number of employee turnovers due to sickness, disability and death against the investments made in the WPP and EWP to see if there were any visible indications of a possible association between the investments and an expected reduction in the productivity indicators.

Given the methodological impossibility to draw any significant conclusions, these graphs should be viewed with greatest caution. In order to establish any cause and effect conclusions from investments made in EWPs, it would have been necessary to establish a clear baseline before any interventions in order to facilitate a before and after "treatment" study. In such a setting, with reliance on so many sources of potentially sensitive data, and with so many steps needed to collect and collate the data from each employer, it would be very difficult to control for the many sources of bias and confounding which could arise. The use of a random controlled trial would be the best option for preventing and controlling for bias, but as mentioned above, would require a inappropriately large investment, particularly in such a methodologically challenging "field" setting.

As well, the intervention of the EWPs can be compared to moving targets, having evolved over the years from HIV/AIDS programmes to more comprehensive EWPs. Any effects which may seem plausible would be very difficult to accord to any particular elements of these programmes, or indeed at all to any programme as a whole. For example, a reduction in medical claims made could be due to the increasing enrolment of employees in the NHIS, or to the EWP or both.

The incompleteness and relatively poor quality of most of the historical data makes the analysis even more questionable. For example, the financial contributions made by the GIZ,

and the programme target employers were made on programme level and the productivity loss indicators were collected from each of the GRA components (VAT, RAGB, CEPS, IRS). These statistics were not complete across all components for any single indicator and thus could not be plotted against the programme investments in total.

In the second area, that of **the model**, the analysis opportunities have been built in to the model in the form of scaling factors and user inputs which permit every user to adjust the model to reflect user-specific conditions. The default values of the scaling factors concerning the incidence of disease and prevalence of risk factors have been left to reflect published Ghana national health statistics, which have as far as possible been found for urban, adult populations disaggregated by sex.

Calibration of the model

The scaling factors for calculating the number of sick days due to outpatient morbidity have been set to 110% of the inpatient average duration of stay in hospital for each disease, as provided by the NHIS manual[24] referred to previously. This value was established based on a comparison with the only complete data set available, that of the VAT employee population of just over 1000 which provided data sets for the years 2007-2010. The model was calibrated in accordance with the average of these four data sets so that the total sick days and death benefit days corresponded to the average of the historical data sets.

The estimation of productive days lost (presenteeism) is based directly on a scaling factor as an additional proportion of the already established sick days calculated. This has been conservatively set as a default value of 25%. The scaling factor for estimating lost productive days due to the presence of health risks has been left at 1.0 (100%) to reflect the values suggested by Goetzel et al 2009[21] in their large scale study of Novartis employees in the USA. These scaling factors may be adjusted by the user to reflect local contexts.

The cost calculation of the burden of disease estimate made by the model is based simply on the average gross salary cost of a work day. This value may be changed by the user by changing the inputs of employee numbers, total annual salary, works days per year, and the death benefit ratio. The lost work days are then multiplied by the average cost of a work day to estimate the cost of lost productive days. These costs have been left intuitively simple for easy use and adjustment by the user.

The cost benefit analysis has been integrated into the model on the interventions, costs and benefits sheet, in which selected interventions have been provided with default estimates of cost, effect and benefit in GHS to then be able to calculate cost benefit ratios and makes calculations of net benefit. The user may adjust all of the elements on this sheet to reflect the local context or to perform "what if?" calculations.

3.7 Validity and reliability

The model-forecasted burden of disease for an employer has been partly validated in comparison to historical data collected from the target employers of the GIZ supported WPP/EWPs. The historical data includes data for actual sick days, as recorded for the employee population. The completion of more of the requested historical data sets would permit further validation and calibration of the model concerning the estimate of sick days and death benefit days. As more data sets become available, the possibility to check the reliability of the model estimate increases.

The estimates of lost productivity due to presenteeism, both as a proportion of sick days, and as a reflection of the presence of health risks can only be confirmed through a prospective study in which employees are requested to complete a presenteeism survey as had been done for numerous studies in the USA. Many studies (mostly from high income countries) have substantiated the theory of presenteeism, though the means to measure it are all connected with more or less serious methodological challenges.

The estimates of the costs and benefits of the interventions included in the model may only be validated in a *prospective study*, though the estimates of effectiveness of the malaria interventions are documented by countless studies also from Ghana. The effectiveness values of the heath risk assessment interventions proposed by the model are set at very conservative values, due to lack of context specific literature to validate them. Again, the need for a prospective study in this area should not be underestimated.

3.8 Assumptions

The model for estimating the burden of disease faced by an employee population is based on numerous assumptions, due to lack of context specific data. In general, the model relies on the Ghana national epidemiological data available from the GHS, the NHIS, and the WHO. These have been selected as far as available to reflect the urban, adult population disaggregated by sex. The statistics used by the NHIS manual[24] have been used to estimate the relative proportion of outpatient morbidity to inpatient morbidity.

The same manual has been used to estimate the number of sick days due to outpatient morbidity based on the disease specific average length of inpatient stays in hospital. The outpatient average duration of illness, derived as a default proportion of 110% of the inpatient average stay in hospital has been assumed to equal the number of sick days for each case of each disease or condition. There is a further option to use the limited number of disease specific average durations of episode of illness available from the authors[25] of the Global Burden of Disease programme, which provide somewhat higher estimates than the other method. These BoD estimates are based on statistics for sub-Saharan Africa.

The presenteeism estimates have been (very) conservatively estimated to be 25% of the calculated sick days for each disease and condition. The presenteeism estimated to be attributable to the presence of risk factors is calculated based on Ghana national prevalence data, some of which is specific for the urban civil service population of Accra, which is very similar to the target populations of employees. The estimates of these extra days of presenteeism due to the presence of risk factors is based on the Goetzel et al 2009[21] study of Novartis employees in the USA.

The cost calculation of the burden of disease estimate made by the model is based simply on the average gross salary cost of a work day, which is employer specific and can be provided in the input sheet of the model. The default values reflect the GRA-VAT data set for 2010, adjusted to a round thousand total population. The death benefit has been assumed to be six months' salary which has been used to calculate average yearly days lost for each disease based on the mortality rates defined above. This averaging is a way of annualising the costs of these days due to death, which in reality are all or nothing propositions.

The example inputs made in the interventions, costs and benefits screen are based on studies of the cost and effectiveness of malaria interventions from Africa and otherwise are estimates deemed to be plausible by the authors of this study pending actual revision by the user (health risk assessment, check-up). The costs have been annualised by simply dividing the investment needed in the first year by the expected duration of the intervention. The benefits have also been estimated as an annual reduction of incidence and mortality with the respective reduction in work days lost valued as described above.

Finally, the model does not explicitly include examples of treatment interventions, due mostly to the situation that treatment costs have largely been externalized through NHIS enrolment of employees since 2011. As well, employers are not well positioned to estimate the benefits (effectiveness) of treatment interventions, though they could consult a public health expert for advice.

There was discussion of the implementation of a top-up healthcare insurance to cover the employees for most of what the NHIS/GHS will not cover free-of-charge. The costs of insurance premiums have also been ignored in the context of this study, as being yearly costs independent of any benefit these may derive.

3.9 Scope and limitations

The **perspective of employer** has very broad ranging effects on the scope of the model and its use. This perspective precludes the estimation of costs and benefits which may accrue to the employees directly, such as transport costs to health facilities, an increase in wellbeing or a reduction in sickness suffered for themselves or their children (use of ITNs or IRS), secured incomes for their families through a reduction in deaths and disabilities, etc.

There are also many **societal aspects** which have been ignored, but could certainly be significant, such as the multiplier effect of well-informed employees concerning health risk reduction, being role models in the use of bed nets or internal residual spraying to reduce the malaria incidence or the benefits of being enrolled in the NHIS, to name a few examples. The benefits to society in this specific case of a healthier GRA could result in higher tax incomes for the benefit of the entire country, or better water supply due to healthier, more productive GWCL/AVRL workforces.

The effects of healthier workforces in these target populations may also affect the resource flows and allocations of the GHS and other healthcare facilities in the catchment areas responsible for the GRA/GCNet and GWCL/AVRL employees. This may be particularly interesting if a noticeable shift from treatment to preventive interventions would be established.

Further, the study and the model focussed on providing a user-friendly tool for informing investment decisions in the health and well-being of an employer's staff. The tool is based on easily collectible and understandable data (for non-scientists), and tries to avoid the blackbox syndrome of calculating burden of disease by rigid scientific methodologies.

This applies, for example, to assumptions made for the model, to base the "cost" of the productivity losses on the simply calculable average salary cost per work day. There are more elaborate estimates of lost productivity in use, such as the so-called **Human Capital (HC) method**, which estimates the actual wage cost of the lost hours and days of the absent employee for as long as the employee is absent. For short term absences the model estimates would largely agree with the HC estimates. In the case of long-term disability or death, the model caps the losses to the six-month salary death benefit amount and the HC method would continue to add the costs well into the future. "This human-capital method has been criticized as calculating potential rather than actual productivity costs, leading to unrealistically high estimates of productivity costs. In particular, it ignores the possibility of replacement of long-term absentees..."[31]

The **friction cost (FC) method**, an alternative suggested in the literature[32] [33], is proposed by some as a better measure of lost production costs from a *societal perspective,* and assumes that an absent employee will be replaced from within the organisation or by hiring a new employee and that the cost is therefore limited to the period until the employer is replaced. Both the HC and the FC methods require more explicit data and can be used when conducting prospective economic evaluations, in which each case is considered individually.

The model has been purposely kept simple and estimates the productivity losses as the wage costs of the forecasted days lost based on the model's epidemiological profile for the employee populations.

The underlying emphasis on making **conservative estimates of burden of disease**, with equally **conservative estimates of intervention costs and benefits**, with the option to adjust according to the specific context should enhance the acceptance and use of the tool. This will in turn, should reflect on the quality of investment decisions made by employers in the interventions of future EWPs.

One crucial limitation was the lack of required data requested for the analysis of historical productivity loss indicator data. This was mostly explained by the lack of centralized and digitalized record keeping both for financial information and for human resources information. These were often kept at lower than department level in the GRA and many of the indicators such as sick leave days were not collated at department or agency level. It was mentioned that this was soon to change with the restructuring of the GRA and the implementation of

digitalized record keeping at agency level. This holds promise for the future ability to gather needed data more easily and reliably than was possible for this study of historical data.

3.10 Sensitivity analysis

The model has been designed to permit "what if" analysis by changing inputs and scaling factors for the many variables which are used to calculate the burden of disease in terms of days lost and the cost of these days to the employer. This was necessary due to the paucity of epidemiological data specific for the target population(s), but also the lack of information about the relation between sickness and loss of productivity lead to substantial uncertainties in the predicted outcomes. The model implementation therefore supports the end user in performing explorative sensitivity analyses to study the effect of varying assumptions about the values of different scaling factors used in the model algorithms.

The following example illustrates such an explorative analysis for two of the model parameters: selected model endpoints are expressed as function of the following inputs:

- k , which scales lost productivity due to presenteeism as a function of the predicted absence days caused by morbidity, and is the scaling factor which is arguably most difficult to calibrate against historical data.
- m , which calculates the number of days away from work per episode using a duration proxy.

The base assumption used in the analysis puts the value of k at 25%, and considers 50% and 200% as alternatives. Similarly, m is studied under its base assumption value (1.1) relative to admission days, and two alternatives (1.0,1,5). The predictions of the resulting loss of productivity, consequent cost for the employer, as well as the predicted cost-benefit ratio of a possible intervention (MAL-1) are shown in the table below:

Scale Factor k : Presenteeism	Scale Factor m : Duration of Episodes	Total Working Days Lost	Total Cost [GHS]	Cost-benefit Ratio: MAL-1
25%	1.0	1824	126’087	0.9
	1.1	**1913**	**132’245**	**0.82**
	1.5	2270	156’878	0.6
50%	1.0	2000	138’279	0.76
	1.1	2107	145’656	0.69
	1.5	2534	175’166	0.5
200%	1.0	3059	211’431	0.38
	1.1	3271	226’123	0.35
	1.5	4121	284’893	0.25

Table 6: Relationship between the assumed magnitude of presenteeism, duration of absence periods, and various model endpoints. (Parameter values in bold indicate baseline assumptions.)

4 Results

4.1 WPP/EWP historical data

As explained previously in this report, the data which were requested to permit a visible comparison over time of productivity loss indicators on the one hand, and the investments made in the WPP/EWP on the other were not made available in sufficient completeness or quality to facilitate any meaningful analysis. The data sets which were the most complete, as mentioned above were those for the VAT department of the GRA for the years 2007-2010. Below is a graphical presentation of the data:

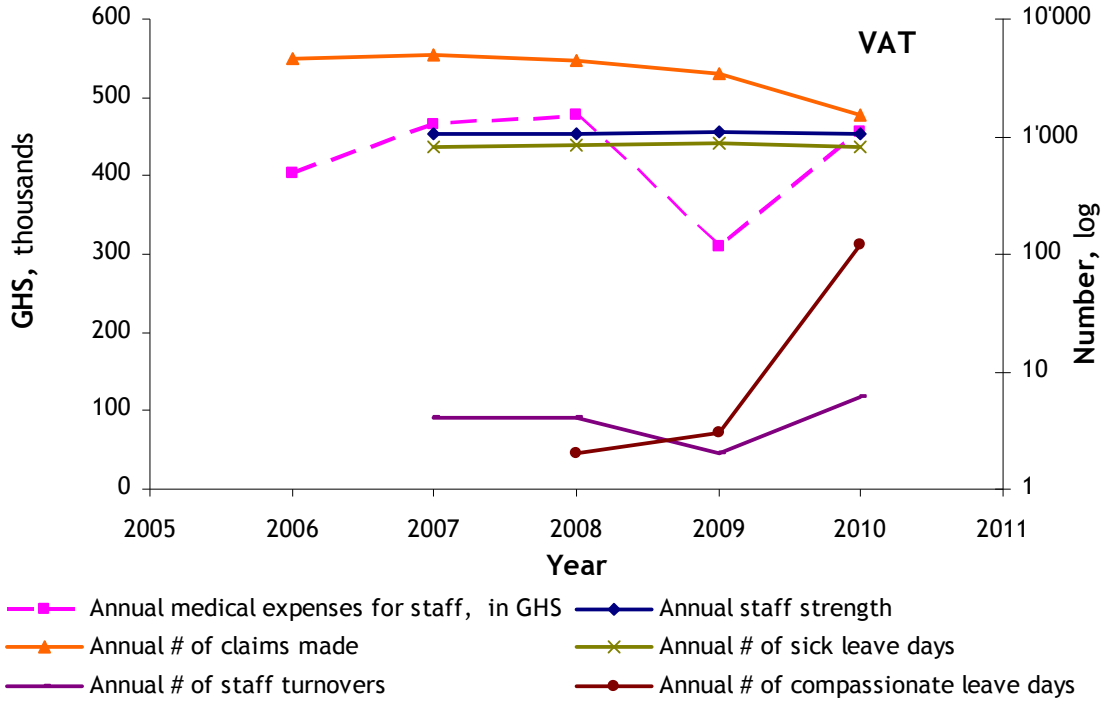


Figure 1: WPP/EWP historical data.

It is evident from the graph that there can be no conclusions drawn about the effect of the investments in WPP/EWP during this same time period in terms of the productivity loss indicators represented here. It is not possible to make any statement about how long after an investment that one may be able to observe which effect, for example.

A historical comparison of burden of disease costs to employers against investments made in WPP/EWP must be acknowledged to be methodologically questionable. The lack of random sampling from target and control populations renders any significance testing impossible. Such comparisons cannot be used to validate any cause and effect relationship which may seem observable. These shortcomings may best be addressed in a methodologically stringent prospective study of adequate duration.

4.2 Model forecasts

4.2.1 Minimal fine-tuning of the model was necessary

The model is a novel attempt to collect epidemiological evidence of incidence of disease and prevalence of risk factors which may be applied to the target populations of employees and convert these burdens of disease into measures of productivity losses in terms of work days lost, which in turn can be converted into a measure of monetary loss based on the cost of a work day. The model attempts to use units of measurement which are intuitively understandable for the target employer/user. These have been kept purposely as broadly understandable as possible, to avoid the "blackbox" syndrome which could prevent the tool from being utilised by the employers.

The tool allows each of the elements to be adjusted to reflect actual contexts prevailing within a particular group of employees. For our analysis, these values have been left unchanged to reflect the national Ghanaian epidemiological profile for urban adult populations disaggregated according to sex. The model estimates based on these estimates of incidence of disease and prevalence of risk factors compared well in terms of overall work days lost due to sickness and also in terms of days paid out as death benefits when compared to the VAT historical data for the years 2007 to 2010.

The model was calibrated on the basis of this data by adjusting the factor used to estimate the number of outpatient sick days as proportion of the average length of stay for the same disease in hospital. The factor of 110% served well to make overall estimates congruent with the historical data provided. (The assumption being made here is that for every outpatient case of a disease the number of days sick is equal to 110% of the reported average stay in hospital for an inpatient case of the same disease.)

The **added value of the model** is in providing an evidence-based explanation for these lost productive days in accordance with the expected disease profile of the employee population.

4.2.2 Gender-related deviations?

The model estimated surprisingly accurately the total number of sick and death benefit days for the **average** 2007-2010 VAT population. There were however, surprising results when the estimates were considered separately by sex. The model overestimated the total days sick days due to morbidity for male employees by a factor of 180% and the overall sick days plus death benefit days for male employees by a factor of 141%. On the other hand, the model underestimated the total sick days due to morbidity for female employees to be only 41% of the actually reported days and underestimated the total sick days plus death benefit days for female employees to be only 52% of the actually reported days.

Employees from:	**VAT**	**VAT**	**VAT**	**VAT**	**VAT**
Year	**2007**	**2008**	**2009**	**2010**	**Average**
Number of male employees	818	820	829	810	819
Number of female employees	214	249	264	258	246
Number of working days per year	217	217	217	217	217
Death Benefit (proportion of working days per year)	0.5	0.5	0.5	0.5	0.5
Actually reported data					
Sick days morbidity M&F	825	860	897	812	849
Sick days morbidity M	227	370	451	365	353
Sick days morbidity F	598	490	446	447	495
Number of Staff turnovers due to sickness, disability, death	4	4	2	6	4
Number of Staff turnovers M	4	3	2	4	3
Number of Staff turnovers F	0	1	0	2	1
Work days lost due to staff turnovers M&F	434	434	217	651	434
Work days lost due to staff turnovers M	434	326	217	434	353
Work days lost due to staff turnovers F	0	109	0	217	81
Total work days lost (morbidity and turnovers) M&F	1259	1294	1114	1463	1283
Total work days lost (morbidity and turnovers) M	661	696	668	799	706
Total work days lost (morbidity and turnovers) F	598	599	446	664	577
Model estimates					
Sick days morbidity M&F	809.17	839.38	858.63	839.00	836.55
Sick days morbidity M	633.92	635.47	642.44	627.72	634.89
Sick days morbidity F	175.25	203.91	216.19	211.28	201.66
Sick days death benefits M&F	447.08	462.11	472.15	461.34	460.67
Sick days death benefits M	360.56	361.44	365.41	357.03	361.11
Sick days death benefits F	86.52	100.67	106.74	104.31	99.56
Total work days lost (morbidity and turnovers) M&F	1'256.25	1'301.49	1'330.78	1'300.34	1'297.22
Total work days lost (morbidity and turnovers) M	994.48	996.91	1'007.85	984.75	996.00
Total work days lost (morbidity and turnovers) F	261.77	304.58	322.93	315.59	301.22
Comparison estimate/actual					
Sick days morbidity M&F	**98.1%**	**97.6%**	**95.7%**	**103.3%**	**98.6%**
Sick days morbidity M	**279.3%**	**171.7%**	**142.4%**	**172.0%**	**179.7%**
Sick days morbidity F	**29.3%**	**41.6%**	**48.5%**	**47.3%**	**40.7%**
Work days lost due to staff turnovers M&F	**103.0%**	**106.5%**	**217.6%**	**70.9%**	**106.1%**
Work days lost due to staff turnovers M	**83.1%**	**111.0%**	**168.4%**	**82.3%**	**102.4%**
Work days lost due to staff turnovers F	**#DIV/0!**	**92.8%**	**#DIV/0!**	**48.1%**	**122.3%**
Total work days lost (morbidity and turnovers) M&F	**99.8%**	**100.6%**	**119.5%**	**88.9%**	**101.1%**
Total work days lost (morbidity and turnovers) M	**150.5%**	**143.3%**	**150.9%**	**123.2%**	**141.1%**
Total work days lost (morbidity and turnovers) F	**43.8%**	**50.9%**	**72.4%**	**47.5%**	**52.2%**

Table 7: Gender-related deviations?

These surprising results would need to be explored in terms of the accuracy of the gathered data and whether the model has missed to take into account context related differences in behaviour in terms of taking sick leave between men and women. The results suggest that

men take about half as much sick leave, and that the women take about 2-1/2 times as much as the model suggests they should.

4.2.3 Presenteeism

The inclusion of estimates for presenteeism based on the same disease profile and the prevalent health risk factors has added a further dimension to the issue of productivity losses. The insight gained by the employer into possible causes of the reported absentee days and the "unseen" productivity losses due to presenteeism inform decision-making about investments in interventions as part of a EWP.

The estimates of productive days lost due to presenteeism as a proportion of sick leave days are very conservative. The additional presenteesim days included due to the presence of health risk factors are also calculated conservatively as the additional lost productive days estimated in the study of Novartis employees over those presenteesim days found where these risk factors were not present.

The estimates of presenteeism could not be verified from the historical data and would need to be verified in a prospective study using one of the many presenteeism survey tools which have been developed and tested in depth in the USA.

4.2.4 Malaria, hypertension, HIV/AIDS

As mentioned earlier in section three, the model suggests, for example, that almost one quarter of the productivity losses can be explained by the incidence of malaria in the employee population and the costs of these lost days also provide the employer with a conservative estimate of the magnitude of the malaria problem in financial terms. The model proposes that over half of the productivity losses measured in terms of work days lost can be explained by the incidence of non-acute diseases and the prevalence of health risk factors. Acute diseases account for most of the rest of the lost productive days:

VAT Average 2007-2010 Population

Disease / Risk Factor	Percent of Productivity losses
Malaria	**24.99%**
Non-acute diseases & risk factors	**50.98%**
Hypertension	12.42%
HIV/AIDS	7.34%
Skin diseases	5.87%
Obesity	5.65%
Physical Inactivity	3.28%
Diabetes Mellitus	3.04%
Tuberculosis	3.54%
Intestinal worms	1.26%
Cerebrovascular disease	1.46%
Anaemia	1.15%
Ischaemic heart disease	1.34%
Alcohol	0.97%
Diet	0.18%
Breast cancer	0.16%

Disease / Risk Factor	Percent of Productivity losses
Acute diseases	**22.91%**
Infection upper respiratory tract	4.20%
Diarrhoeal diseases	4.42%
Acute eye infections	2.71%
Home/occupational injuries	2.38%
Road traffic injuries	1.94%
Tropical-cluster diseases	1.39%
Typhoid fever	1.03%
Violence	1.10%
Other unintentional injuries	1.00%
Pneumonia	0.73%
Lower respiratory infections	0.84%
Acute ear infection	0.68%
Other oral conditions	0.33%
Total	**98.72%**

Table 8: Productivity losses in percent per disease/risk factor for VAT Average 2007-2010 Population.

These estimates are obviously very sensitive to the proportions of male and female employees, given their differing disease profiles and are here shown above as a total of both populations. The sex-disaggregated estimates are also provided by the model for each of the contributing factors: sick days due to morbidity, presenteeism due to sickness, presenteeism due to the prevalent health risk factors, and days lost due to employee turnovers (death benefits). Below is an example for sick leave days:

Calculated Annual Work Days Lost (Sick leave)
VAT average population 2007 - 2010
Disease specific number of episodes and calculated absence days

Disease	*Number of Episodes Male Employees*	*Hospital admissions Male Employees*	*Number of Episodes Female Employees*	*Hospital admissions Female Employees*	Absence Days Male Employee	Absence Days Female Employee	Total Absence Days
Malaria	86.84	0.95	26.75	0.33	**305.68**	**94.59**	**400.27**
Skin diseases	8.05	0.03	2.42	0.01	**73.51**	**22.10**	**95.61**
Infection upper respiratory tract	13.29	0.03	3.99	0.01	**52.63**	**15.82**	**68.45**
Acute eye infections	4.35	0.01	1.31	0.00	**33.94**	**10.20**	**44.14**
Diarrhoeal diseases	8.05	0.13	2.42	0.04	**30.11**	**9.05**	**39.16**
Home/occupational injuries	4.38	0.08	1.32	0.03	**29.90**	**8.99**	**38.89**
Hypertension	5.70	0.08	1.71	0.02	**26.98**	**8.11**	**35.09**
Intestinal worms	3.07	0.03	0.92	0.01	**15.85**	**4.76**	**20.61**
Anaemia	3.30	0.21	0.99	0.06	**14.51**	**4.36**	**18.87**
Typhoid fever	1.75	0.00	0.52	0.00	**12.87**	**3.87**	**16.74**
Pneumonia	1.84	0.15	0.55	0.05	**9.33**	**2.80**	**12.13**
Road traffic injuries	1.75	0.06	0.52	0.02	**8.84**	**2.66**	**11.49**
Acute ear infection	1.84	0.02	0.55	0.01	**8.52**	**2.56**	**11.07**
Diabetes Mellitus	0.91	0.02	0.27	0.01	**8.12**	**2.44**	**10.57**
Other oral conditions	1.20	0.00	0.36	0.00	**4.10**	**1.23**	**5.33**
Pregnancy and related complications	0.00	0.00	1.18	0.04	**0.00**	**4.95**	**4.95**
Gynaecological conditions	0.00	0.00	0.76	0.04	**0.00**	**3.17**	**3.17**
Rheumatic and joint diseases	3.71	0.00	1.11	0.00	**0.00**	**0.00**	**0.00**
Dental caries	1.20	0.00	0.36	0.00	**0.00**	**0.00**	**0.00**
Total	**151.23**	**1.81**	**48.05**	**0.66**	**634.89**	**201.66**	**836.55**

Table 9: Calculated Annual Work Days Lost (Sick leave), VAT average population 2007-2010.

The conversion of these lost days of productivity into financial terms is realised in the model by providing the inputs of the numbers of male and female employees, the annual total gross salary expenditure for these same employees, the number of working days annually and also the factor for calculating the death benefits in case of mortality as a proportion of the annual working days. These inputs permit the model to calculate an average cost of a working day. This average cost is then used to convert the estimate of lost productive days into a financial loss by simple multiplication.

These losses can be viewed per disease as a total:

Costs Contributions of Morbidity, Mortality and Risk Factors by Condition
VAT 2010 Population

Total costs [GHS]

Disease / Risk Factor	Costs Morbidity	Costs Presenteeism (due to morbidity)	Costs Presenteeism (due to risk factors)	Costs Mortality	Total Costs per Disease / Risk Factor	Percent of Total Costs
Malaria	28'915.46	7'146.90	n.a.	662.87	36'725.22	24.97%
Hypertension	2'534.12	624.88	15'094.36	n.a.	18'253.37	12.41%
HIV/AIDS	n.a.	n.a.	n.a.	10'802.56	10'802.56	7.34%
Skin diseases	6'904.58	1'720.13	n.a.	n.a.	8'624.72	5.86%
Obesity	n.a.	n.a.	8'470.70	n.a.	8'470.70	5.76%
Diarrhoeal diseases	2'828.38	695.67	n.a.	2'965.75	6'489.81	4.41%
Infection upper respiratory tract	4'943.16	1'233.26	n.a.	n.a.	6'176.41	4.20%
Tuberculosis	n.a.	n.a.	n.a.	5'154.88	5'154.88	3.50%
Physical Inactivity	n.a.	n.a.	4'870.57	n.a.	4'870.57	3.31%
Tobacco	n.a.	n.a.	4'815.84	n.a.	4'815.84	3.27%
Diabetes Mellitus	763.12	186.42	3'510.70	n.a.	4'460.24	3.03%
Acute eye infections	3'188.00	795.82	n.a.	n.a.	3'983.81	2.71%
Home/occupational injuries	2'808.74	688.78	n.a.	n.a.	3'497.52	2.38%
Road traffic injuries	829.87	199.78	n.a.	1'803.40	2'833.05	1.93%
Cerebro-vascular disease	n.a.	n.a.	n.a.	2'146.37	2'146.37	1.46%
Tropical-cluster diseases	n.a.	n.a.	n.a.	2'025.17	2'025.17	1.38%
Ischaemic heart disease	n.a.	n.a.	n.a.	1'957.06	1'957.06	1.33%
Intestinal worms	1'488.56	368.05	n.a.	n.a.	1'856.61	1.26%
Anaemia	1'363.08	319.47	n.a.	n.a.	1'682.55	1.14%
Pregnancy and related complications	373.54	90.23	n.a.	1'209.80	1'673.58	1.14%
Violence	n.a.	n.a.	n.a.	1'597.01	1'597.01	1.09%
Typhoid fever	1'208.73	301.58	n.a.	n.a.	1'510.31	1.03%
Other unintentional injuries	n.a.	n.a.	n.a.	1'456.75	1'456.75	0.99%
Alcohol	n.a.	n.a.	1'428.29	n.a.	1'428.29	0.97%
Lower respiratory infections	n.a.	n.a.	n.a.	1'213.11	1'213.11	0.82%
Pneumonia	875.98	200.79	n.a.	n.a.	1'076.76	0.73%
Acute ear infection	799.81	197.76	n.a.	n.a.	997.56	0.68%
Other oral conditions	385.27	96.25	n.a.	n.a.	481.52	0.33%
Gynaecological conditions	239.21	56.65	n.a.	n.a.	295.86	0.20%
Diet	n.a.	n.a.	273.35	n.a.	273.35	0.19%
Breast cancer	n.a.	n.a.	n.a.	244.76	244.76	0.17%
Rheumatic and joint diseases	n.a.	n.a.	n.a.	n.a.	0.00	0.00%
Dental caries	n.a.	n.a.	n.a.	n.a.	0.00	0.00%
Total Costs	60'449.61	14'922.42	38'463.83	33'239.50	147'075.34	100%

Table 10: Costs Contributions of Morbidity, Mortality and Risk Factors by Condition, VAT 2010 population.

The sex-disaggregated cost estimates are also provided by the model for each of the contributing factors: sick days due to morbidity, presenteeism due to sickness, presenteeism

due to the prevalent health risk factors, and days lost due to employee turnovers (death benefits). Below is an example for sick leave days:

Costs due to Absence Days (Sickness)
VAT 2010 Population

Disease costs due to absence days [GHS]

Disease	*Costs Male Employees*	*Costs Female Employees*	Total Costs
Malaria	21'775.35	7'140.10	28'915.46
Skin diseases	5'236.62	1'667.96	6'904.58
Infection upper respiratory tract	3'749.02	1'194.13	4'943.16
Acute eye infections	2'417.86	770.13	3'188.00
Diarrhoeal diseases	2'145.12	683.26	2'828.38
Home/occupational injuries	2'130.22	678.52	2'808.74
Hypertension	1'921.94	612.18	2'534.12
Intestinal worms	1'128.96	359.60	1'488.56
Anaemia	1'033.79	329.28	1'363.08
Typhoid fever	916.73	292.00	1'208.73
Pneumonia	664.36	211.61	875.98
Road traffic injuries	629.40	200.47	829.87
Acute ear infection	606.59	193.21	799.81
Diabetes Mellitus	578.77	184.35	763.12
Other oral conditions	292.20	93.07	385.27
Pregnancy and related complications	0.00	373.54	373.54
Gynaecological conditions	0.00	239.21	239.21
Rheumatic and joint diseases	0.00	0.00	0.00
Dental caries	0.00	0.00	0.00
Total costs	45'226.97	15'222.64	60'449.61

Table 11: Costs due to Absence Days (Sickness), VAT 2010 population.

4.3 Interventions, costs and benefits

The model sorts the top sources of productivity losses estimated into the three categories mentioned earlier in order to explore possible interventions which the employer can undertake as part of the EWP. **For all of the categories, it is possible to add own interventions for consideration.**

4.3.1 Category one: malaria

The category of **malaria** offers two preventive interventions: insecticide treated bednets (long-lasting insecticide impregnated bednets LLIN) and internal residual spraying and a combination of both. For each intervention there are estimates of cost per employee, effectiveness in terms of malaria incidence and fatality prevented by these interventions and the related work days saved, and the value of these days saved in terms of the salary expenditure saved. This information is then used to calculate a cost benefit ratio and the net benefit.

It is possible to modify all of the variables according to local context in order to calculate a more accurate CBR and net benefit. For example, it may be possible to obtain LLIN from the global Roll Back Malaria programme for free. In this case, the annual costs per employee could be reduced by the costs of the nets and only programmatic costs need be estimated.

4.3.2 Category two: non-acute diseases and prevalent risk factors

The second category of **non-acute diseases** and **prevalent risk factors**, which the model suggests to be responsible for over half of the productivity losses offers little in the way of interventions which the employer could offer as this category has many different elements which alone are relatively "inexpensive" and for which preventive measures are many-fold. The model suggests that the most obvious first step in dealing with these diseases and conditions is to encourage each employee to have a regular health check-up. In the context then of a doctor-patient relationship it is assumed that each employee will become aware of any need for treatment or for reducing health risks.

The employer could offer incentives to encourage this, and could also arrange for in-house health checks to bring the opportunity closer to the employees on a regular basis. The calculations of a CBR and net benefit for these are highly context related and estimates of the effectiveness of regular check-ups are difficult to make. The model allows for "what-if" parameter changes to explore when the CBR and net benefits become favourable to the employer.

Here is an example in summary form of the results of the CBA for suggested interventions:

Disease / Risk Factor	Cost of Problem	Percent of Problem	Intervention Type	Annual Cost per Employee [GHS]	Annual Cost of Intervention [GHS]	Annual Benefit [GHS]	Cost / Benefit Ratio	Net Benefit [GHS]
Malaria	**32'764.30**	**24.78%**	MAL-1 : Insecticide-treated bed nets (ITN)	**13.33**	**13'330.00**	**16'203.51**	**0.8227**	**2'873.51**
			MAL-3 : Indoor residual spraying (IRS)	**18.05**	**18'050.00**	**16'203.51**	**1.1140**	**-1'846.49**
			Both MAL-1 and MAL-3	**31.38**	**31'380.00**	**23'012.56**	**1.3636**	**-8'367.44**
Non-acute diseases & risk factors	**67'517.88**	**51.06%**	Health risk assessment (in-house)	**19.30**	**19'300.00**	**6'751.79**	**2.8585**	**-12'548.21**
			Health risk assessment (go to doctor)	**35.50**	**35'500.00**	**6'751.79**	**5.2579**	**-28'748.21**

Table 12: An example in summary form of the results of the CBA for suggested interventions.

4.3.3 Category three: acute diseases

The third and final category of **acute diseases**, which the model suggests to account for most of the rest (about one quarter) of productivity losses is one in which the employer can do very little and indeed need not do much as the employees will likely be self-motivated by the acuteness of the condition to seek appropriate care in a timely manner. The model does not suggest any specific interventions, but does allow the user to add interventions also for this category.

4.4 Positive net benefits?

With reference to the study's research hypothesis, there are indeed positive net benefits to be realised by the employer in investing in interventions to preserve and improve the health status and well-being of the employees. The examples shown are based on very conservative estimates of costs and benefits. For many of the interventions, it may be possible to reduce the annual costs per employee if there are national or global programmes which may provide material or programmatic support, such as for malaria, HIV/AIDS, or maternity conditions.

Also, the estimates of effectiveness of the health risk assessments are also very conservative, due to the difficulty, for example, to estimate rates of participation, which diseases and conditions will be diagnosed and treated, as well as the time-frame in which each of these treatments will result in noticeable improvements in productivity.

Even where there may be negative net benefits, given the narrow perspective of the study, these interventions may still be worthwhile for the employer to invest as the benefits which may accrue to the employee, families and community may be substantial and provide a way for an employer to enhance its status as an attractive employer and a good corporate citizen.

4.5 What-if...?

As all of these input variable are highly context related, the model permits adjustment as needed, as better information becomes available. The model provides moreover a very useful tool to analyse the various options by conducting what-if analysis by varying the inputs accordingly. The calculation of the expected CBR and net benefit inform the employer of the ranges for each intervention which still result in a positive result.

5 Conclusions and Recommendations

5.1 Summary

The study of the employee wellbeing programmes supported by the GIZ in Ghana has proven to be a challenge in terms of collecting the data needed, and more so to reconcile to the requirements of a scientific research methodology with the pragmatic needs of employers and the conditions prevailing in the context of Ghana. The model, which was developed to provide employers with evidence-based estimates of productivity losses measured in simple terms of work days lost, has attempted to bridge the gap between these.

The model makes a novel attempt to convert epidemiological data (population incidence and prevalence rates) into measures which an employer can understand related to the population of the employees. The model provides a forecast of which diseases and conditions are likely to cause how many lost production days in order to inform investment decisions aimed at improving the health and wellbeing of its employees. This is a worthwhile undertaking in own stead, as this provides a clear picture of the most costly "problems". The model goes further and suggests interventions which guide the employer to also be able to estimate what the organisation can expect to gain in terms of improved productivity through implementing these interventions.

The model has, in the authors' opinion, succeeded in putting the knowledge of the epidemiologist at the disposal of employers in a format which is intuitive and helps to explain the causes of productivity losses without the need to undertake an expensive large scale study of employees directly.

The main results of the model are the estimates that employers (employees) of the GIZ supported EWP will be confronted, first and foremost, by the effects of malaria (about a quarter of the problem) and hypertension (about one eighth). The model suggests that over half of the productivity losses can be expected to come from the category of non-acute diseases and prevalent health risk factors. Both of these first two categories provide an employer with some room to act, through preventive interventions. The final category, which explains most of the remaining forecasted productivity losses, offers an employer basically no opportunity to act.

The flexibility of the model allows the user to perform unlimited "what-if?" sensitivity analysis and to adjust the model inputs according to actual conditions prevailing. Still, the statistics behind the model are tailored clearly for the urban, adult population of Ghana and as far as possible to reflect the civil servant profile. These would need to be replaced by actual context data to enable usage outside of the intended context.

5.2 Discussion

The study results are based on a number of assumptions and on historical data which are both cause for considerable uncertainty. In most of the assumptions, conservative, plausible choices were made in order to err, if so, on the side of underestimation.

The limiting of the measures of productivity losses to sick days and presenteeism valued at the cost of an average day's salary also lead to conservative estimates of losses and also of benefits from the interventions suggested. The accuracy of the model to explain the causes of productivity losses could only be verified by further research. The employees could be studied to establish the actual disease profile in comparison to the estimate made based on the Ghana national statistics.

A prospective study could strengthen the accuracy of recording of sick days, and could verify through presenteeism surveys, as are conducted in the USA, the estimates of lost productivity over and above actual sick days recorded, though the use of such a survey tool may be biased due to cultural mistrust of admitting on the job productivity losses.

The limitations of the perspective of the employer in this study also underline the conservative estimates of the costs of the BoD and the benefits to be derived through targeted interventions. The full extent of these could be established in a broader study of the costs and benefits with the inclusion of the perspectives of the employees, and their families, and also from the societal perspective. The latter would underline the employer's case for good corporate citizenship.

The model provides the employer with the more specific evidence of the health profile and needs of the employees and allows the employer to tailor the design of the EWP accordingly.

The tool also sensitizes the employers to understanding and using epidemiological information in an intuitive way, paving the way for revising the interventions offered according to changes in the health profile of the employee population. One area which hardly is observable in the currently kept statistics of morbidity in Ghana (and Africa in general) is that of mental health. One example is the estimated prevalence of attention deficit hyperactivity disorder globally of 3-5% of the global adult population as evidenced by a recent WHO 10 country study by de Graaf et al[34] . This disease alone could have a large impact on presenteeism of any workforce, but does not show up in the morbidity statistics in Africa.

5.3 Recommendations

The study and the unique model developed open the way to an evidence based estimation of the health profile of an employee population without the need for conducting an expensive study of the employee population or a sample thereof in order to inform employers of cost-effective interventions they can offer to their employees to improve their health status and their productivity on the job. It is recommended to validate the model and refine it through use by the employers of the GIZ supported EWPs within the framework of a prospective study. This would help to validate the model, to refine the algorithms behind the model and to improve the utility and acceptance of the model for use by employers.

6 References

[1] http://www.gtz.de/en/weltweit/afrika/ghana/32800.htm

[2] de-Graft AA. Ghana's neglected chronic disease epidemic: a developmental challenge. Ghana Med J 2007 Dec;41(4):154-9.

[3] WHO. World Malaria Report: Ghana. available from: http://www.who.int/countries/gha/en/ . 2009. [accessed 4/01/2011]

[4] WHO. WHO Global Health Observatory. available from: http://apps.who.int/ghodata/ . 2009.

[accessed 4/01/2011]

[5] UNAIDS & WHO. Epidemiological Fact Sheet on HIV and AIDS: Core data on epidemiology and response: Ghana. available from: http://www.who.int/countries/gha/en/ . 2008. [accessed 4/01/2011]

[6] Bosu WK. Epidemic of hypertension in Ghana: a systematic review. BMC Public Health 2010;10:418.

[7] Addo J, Smeeth L, Leon DA. Prevalence, detection, management, and control of hypertension in Ghanaian civil servants. *Ethn Dis* 2008;18(4):505-11.

[8] WHO. WHO Global Infobase - data for saving lives: country profiles. available from: https://apps.who.int/infobase/CountryProfiles.aspx. 2010. [accessed 4/01/2011]

[9] Abubakari AR, Bhopal RS. Systematic review on the prevalence of diabetes, overweight/obesity and physical inactivity in Ghanaians and Nigerians. Public Health 2008 Feb;122(2):173-82.

[10] http://www.nhis.gov.gh/_Uploads/dbsAttachedFiles/Slide1.JPG (accessed 14.01.2011)

[11] GCNet was founded in the year 2000 to develop and implement a computerized system for the validation and forwarding of trade and customs documentation. The main stakeholder of GCNet is Societé Generale de Surveillance (SGS) SA of Switzerland (60%). Other shareholders are Customs Excise and Preventive Services (20%), Ghana Shippers Council (GSC) (10%), Ghana Commercial Bank (GCB) (5%) and ECOBANK Ghana (5%). GCNet is a private institution but because of the shareholders structure and the nature of the contract is bound by governmental interest. GCNet automated the Ghanaian Customs Services in the year 2004 and uses computerized systems for the administration of customs documents for clearing of goods at the various entry points as well as the controlling of the related financial transactions. The Company also delivers trade facilitation services in countries such as Nigeria, Cote D' Ivoire, Cameroun and Madagascar within Africa.

[12] Zungu LI, Setswe KG. An integrated approach to the prevention and promotion of health in the workplace: A review from international experience. *South African Family Practice* 2007;49(6):6-9.

[13] Pelletier KR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: update VII 2004-2008. *J Occup Environ Med* 2009;51(7):822-37.

[14] Baicker K, Cutler D, Song ZR. Workplace Wellbeing Programs Can Generate Savings. *Health Aff.* 2010;29(2).

[15] Kirsten W. Making the Link between Health and Productivity at the Workplace -A Global Perspective. *Ind. Health* 2010;48(3):251-55.

[16] Chapman LS. Presenteeism and its role in worksite health promotion. *American Journal of Health Promotion* 2005;19(4):1-8.

[17] Hemp P. Harvard Business Review: *Presenteeism: At work but out of it*, 2004, Vol.82, no.10, p.49-58.

[18] Sainsbury Centre for Mental Health 2007 Policy Paper No. 8 Mental Health at Work: Developing the Business Case.

[19] Goetzel RZ, Pronk NP. Worksite Health Promotion: How Much Do We Really Know About What Works? *American journal of preventive medicine* 2010;38(2):S223-S25.

[20] O'Donnell M, Bishop C, Kaplan K. Benchmarking best practices in workplace health promotion. Art Health Promot 1997;1(1):1– 8.

[21] Goetzel RZ, Carls GS, Wang S, Kelly E, Mauceri E, Columbus D, et al. The Relationship Between Modifiable Health Risk Factors and Medical Expenditures, Absenteeism, Short-Term Disability, and Presenteeism Among Employees at Novartis. *Journal of Occupational and Environmental Medicine* 2009;51(4):487-99.

[22] The Health Sector in Ghana Facts and Figures 2009 http://www.ghanahealthservice.org/includes/upload/publications/Facts and Figures 2009.pdf

[23] http://www.who.int/choice/en/

[24] National Health Insurance Scheme Tariff and Benefits Package Operation Manual 2008.

[25] Murray, Christopher J.L., Alan D. Lopez, Global Health Statistics: a compendium of incidence, prevalence and mortality estimates for over 200 conditions, WHO 1996.

[26] Personal communication with Dr. Adriana Ignea

[27] For a complete list of services provided and exempted by the National Health Insurance Scheme NHIS Benefits Package see: http://www.nhis.gov.gh/?CategoryID=158&ArticleID=120

[28] Morel CM, Lauer JA, Evans DB. Cost effectiveness analysis of strategies to combat malaria in developing countries. BMJ 2005;331(7528):1299.

[29] Kolaczinski J, Kolaczinski K, Kyabayinze D, Strachan D, Temperley M, Wijayanandana N, et al. Costs and effects of two public sector delivery channels for long-lasting insecticidal nets in Uganda. *Malaria Journal* 2010;9(1):102.

[30] Indoor Residual Spraying (IRS) for Malaria Control Indefinite Quantity Contract (IQC) Task Order 1 (TO1) Analysis of 2008 Expenditures in Five IRS TO1 Countries: http://www.fightingmalaria.gov/resources/reports/irs_iqc08.pdf

[31] Brouwer WBF, Koopmanschap MA. The Friction-Cost Method: Replacement for Nothing and Leisure for Free? Pharmacoeconomics 2005;23(2):105-11.

[32] Birnbaum H. Friction-Cost Method as an Alternative to the Human-Capital Approach in Calculating Indirect Costs. Pharmacoeconomics 2005;23(2):103-04.

[33] van den Hout WB. The value of productivity: human-capital versus friction-cost method. Annals of the Rheumatic Diseases 2010;69(Suppl 1):i89-i91.

[34] de Graaf R, Kessler RC, Fayyad J, ten Have M, Alonso J, Angermeyer M, et al. The prevalence and effects of adult attention-deficit/hyperactivity disorder (ADHD) on the performance of workers: results from the WHO World Mental Health Survey Initiative. Occupational and Environmental Medicine 2008;65(12):835-42. http://oem.bmj.com/content/65/12/835.full.pdf

7 Appendices, Tables and Charts

7.1 Appendix 1: Model equations

7.1.1 Estimation of disease-specific annual number of episodes

Due to the paucity of data on disease-specific incidence rates, data on outpatient clinic attendance was used to approximate incidence rates. Malaria –where most data is available- was used as a reference. The disease-specific annual number of episodes E_i (except for the special case of malaria E_m) in the target population were calculated as follows:

$$E_i = c_m \cdot \frac{t_i}{t_m} \cdot f_i \cdot N$$

where

c_m : Incidence of malaria (per person year at risk)

f_i : Disease-specific scaling factor to adjust for the fact that the target population is a non-random sample of the Ghanaian population

t_i : Observed contribution of the disease to total outpatient morbidity

t_m : Observed contribution of malaria to total outpatient morbidity

N : Number of employees

For malaria, the annual incidence was directly available

$$E_m = c_m \cdot f_m$$

f_m : Scaling factor to adjust for the fact that the target population is a non-random sample of the Ghanaian population

This equation makes a number of assumptions: most notable, that national insurance data is proportional to target population, and that the treatment seeking probability is similar for different diseases. These assumptions can be adjusted by a user of the tool by modifying the corresponding disease-specific scaling factors in the “Input parameters” worksheet.

7.1.2 Calculation of disease-specific absence days due to sickness

The model contains two different algorithms for the calculation of the absence days as a function of the annual number of episodes of a disease, and the average duration of absence due to a disease episode. The first uses the reported average duration of hospitalization due to an episode as a proxy. This duration is then scaled to using a scaling factor to calculate the number of absence days caused by an episode. The number of absence days per year A_i is then calculated as

$$A_i = h_i \cdot m_i \cdot E_i$$

where

h_i : The disease-specific duration of hospital days of admitted patients

m_i : A disease-specific scaling factor to relate the hospital stay length to the number of days absent from work due to a disease episode

Where available, the average duration of an episode can also be based alternative data on disease duration and severity, e.g. as published in Murray and Lopez (1996) (REF: Christopher J.L. Murray & Alan D.Lopez, Global Health Statistics, Harvard University Press, 1996). The user can enable this alternative algorithm for the calculation of absence days by ticking the checkbox “Use disease duration and disability weight” in the “Input Parameters” worksheet. Absence days are then calculated as follows:

$$\begin{cases} A_i = l_i \cdot s_i \cdot E_i & \text{if } w_i > C \\ A_i = 0 & \text{if } w_i \le C \end{cases}$$

where

l_i : The disease-specific duration of an episode

w_i : The disease-specific disability during an episode

s_i : A disease-specific scaling factor to map disability to the probability of being absent

C : A threshold which determines whether disease episode cause absence days

7.1.3 Presenteeism (due to morbidity)

The estimated loss of productivity due to presenteeism P_i is based on the disease-specific absence days as a proxy, and calculated as follows

$$P_i = (1 - r_i) \cdot A_i \cdot k_i$$

where

r_i : Disease-specific proportion of cases which are admitted to hospital.

k_i : A disease-specific scaling factor to relate the lost productivity due to presenteeism to absent days

7.1.4 Estimation of disease-specific annual number of deaths

The disease-specific annual number of deaths is derived from national disease specific mortality rates and the number of employees.

$$D_i = g_i \cdot d_i \cdot N$$

where

g_i : Disease-specific scaling factor to adjust for the fact that the target population is a non-random sample of the Ghanaian population

d_i : Disease-specific national mortality rate (per capita)

N : Number of employees

7.1.5 Calculation of disease-specific absence days due to employee turnover

$$T_i = E \cdot V \cdot D_i$$

where

E : Death benefit (proportional factor of total working days per year)

V : The annual number of working days

7.1.6 Presenteeism (due to risk factors)

The estimated number of unproductive days due to extra-morbidity presenteeism Q_i (due to the presence of risk factor), is calculated as follows:

$$Q_i = u_i \cdot p_i \cdot N$$

where

u_i : Risk factor-specific scaling factor to relate presence of a risk factor to lost productivity due to presenteeism

p_i : Risk factor-specific prevalence

7.1.7 Calculation of the impact of health interventions and cost-benefit ratio

The predicted benefit (costs saved) of a health intervention is calculated on the basis the consequent reduction in the costs due to disease and risk factors (including the effects of presenteeism), and to employee turnover.

$$B_i = q_i(rI_i \cdot (tCD_i + tCP1_i + tCP2_i) + rM_i \cdot tCM_i)$$

where

B_i : Benefit (annual cost savings) due to the intervention

q_i : Proportion of employees covered by intervention

rI_i : Reduction in disease or risk factor prevalence

tCD_i : Total cost caused by disease

$tCP1_i$: Total cost due to presenteeism (morbidity)

$tCP2_i$: Total cost due to presenteeism (risk factor)

rM_i : Reduction in mortality

tCM_i : Total cost due to mortality (employee turnover)

The net benefit of a health intervention is calculated as:

$$CBR_i = B_i - IC_i$$

where

IC_i : The annual intervention cost

The cost benefit ratio is given by:

$$CBR_i = \frac{IC_i}{B_i}$$

7.2 Appendix 2: Excel Tool user guide

The Excel tool implements the model algorithms used to calculate total work days lost and costs due to morbidity, mortality and risk factors and provides a set of intervention packages which can be applied to various disease categories. The cost-benefit ratio as well as the net benefit is then calculated.

7.2.1 Excel Settings

The tool uses Excel-Macros for calculation of results. Make sure that the macro security level is set appropriate to allow execution of Macros.

7.2.2 Sections & Navigation

The tool consists of a workbook structured into various sections:

- Data Sources
- Input Parameters & Scaling Factors
- Calculation of predicted work days lost and costs
- Interventions
- Epidemiological data, hospital stays, disease duration and disability weights
- Various information and WHO CHOICE reference sheet

The following screenshot shows the 'Overview & Navigation' worksheet listing all available worksheets of the various categories:

	Tab coding	Worksheet name	Description
3		Data Sources	Sources of data underlying model calculations
5		Input Parameters	Interface allowing the user to specify input parameters such as data related to employees, scaling factors applied to
7		Predicted Work Days Lost	Calculation of predicted work days lost based on the epidemiological profile taking into account in/out patient morbidit
8		Calculated Costs in Detail	Calculation of costs due to in/out patient morbidity, presenteeism and mortality
9		Days Lost Summary	Summary and overvie of total work days lost due to morbidity, risk factors and mortality
10		Cost Summary	Summary and overview of costs due to absences days and presenteeism caused by morbidity, risk factors and mor
12		Interventions, Costs & Benefits	Interface allowing the user to perform calculations based on predefined interventions as well as to define new interv
13		Interventions Summary	Summary table of all interventions for categories malaria, non-acute diseases & risk factors & acute diseases
15		Epidemiological Profile	Table: Incidence rates of specific disease pattern underlying model calculations
16		Risk Factors	Table: Risk factors and impact on annual unproductive days
17		Hospital Stays	Table: Average length of stay in hospital for specific disease pattern
18		Duration & Disability Weights	Table: Disease duration and disability weights
20		Hospital Treatment	Table: Disease specific treatment costs for admitted in-patients
21		Specific Treatment Costs	Calculation of specific costs like e.g. hospital treatment costs
22		WHO-CHOICE Interventions	Reference sheet containing information and links about the WHO initiative CHOICE (CHOosing Interventions that are C

Using the hyperlinks this worksheet allows for easy navigation inside the whole workbook.

7.2.3 Input Parameters

The 'Input Parameters' worksheet is divided into different sections which allow the user to define input parameters, select options related to calculation algorithms and adjust various scaling factors. Changing input parameters and scaling factors will have an immediate impact on calculation results of working days lost and costs.

The first section covers input parameters related to employees like the number of male/female employees, the total annual salary, number of working days and the death benefit proportional factor:

Data related to employees

Input Parameter	Value	Description
Number of male employees	750	Total number of male employees in the company / organisation
Number of female employees	250	Total number of female employees in the company / organisation
Total annual salary cost in Ghana New Cedis [GHS]	15'000'000	Total costs covering the salary of all employees during one year
Number of working days per year	217	Number of working days per year used for calibration of cost calculation
Death Benefit (proportion of working days per year)	0.50	Factor reflecting proporting of death benefit regarding working days per year

In the 'Global Settings' section the user selects one of the model calculation options:

- Calculation based upon average days of stay in hospital
- Calculation based upon disease duration and disability weights

Global settings

Option		Description
Use data for disease duration and disability weight if available (default calculation is based upon average days of stay in hospital)	☐ Use disease duration and disability weight	This option allows the user to specify whether model calculations should be based upon data for disease duration and disability weights or on the disease specific average length of stay in hospital applying certain scaling

Three sections of scaling factors related to morbidity, risk factors and mortality allow the user to further parameterise calculation of total absence days and costs:

Scaling factors related to disease incidence & presenteeism (Optional)

Disease (Male)	Disease incidence scaling factor in relation to national population	Presenteeism scaling factor applied to absence days	Scaling factor ap of hospital days of days away
Malaria	1.00	0.50	
nfection upper respiratory tract	1.00		
Diarrhoeal diseases	1.00		
Skin diseases	1.00		

Scaling factor presenteeism
Insert value greater than 0

The user input is validated and an error message is displayed in case the value is not valid. When a parameter value is changed from its default value, a flag is displayed to indicate that the user is about to perform a sensitivity analysis:

Sensitivity analysis

Sensitivity analysis, baseline values are: 1;0.25;1.1;1
No, using base assumption
No, using base assumption
No, using base assumption

7.2.4 Calculation of predicted work days lost

Based on calculation algorithms described in the report in detail, the worksheet 'Predicted Work Days Lost' contains various tables that give an overview of predicted work days lost caused by morbidity, presenteeism and morality. The following screenshots shows the table of calculated work days lost due to sickness:

Calculated Work Days Lost (Sickness)

Disease specific number of episodes and calculated absence days

Disease	Number of Episodes Male Employees	Hospital admissions Male Employees	Number of Episodes Female Employees	Hospital admissions Female Employees	Absence Days Male Employee	Absence Days Female Employee	Total Absence Days
Malaria	79.50	0.87	26.50	0.29	279.84	93.28	373.12
Infection upper respiratory tract	12.17	0.02	4.06	0.01	48.18	16.06	64.24
Diarrhoeal diseases	7.37	0.12	2.46	0.04	27.57	9.19	36.76
Skin diseases	7.37	0.03	2.46	0.01	67.30	22.43	89.73
Hypertension	5.22	0.07	1.74	0.02	24.70	8.23	32.93
Home/occupational injuries	4.01	0.08	1.34	0.03	27.38	9.13	36.50
Acute eye infections	3.98	0.01	1.33	0.00	31.07	10.36	41.43
Pregnancy and related complications	0.00	0.00	1.20	0.04	0.00	5.02	5.02
Rheumatic and joint diseases	3.39	0.00	1.13	0.00	0.00	0.00	0.00
Anaemia	3.02	0.19	1.01	0.06	13.29	4.43	17.71
Intestinal worms	2.81	0.03	0.94	0.01	14.51	4.84	19.34
Gynaecological conditions	0.00	0.00	0.77	0.04	0.00	3.22	3.22
Malaria in pregnancy	0.00	0.00	0.66	0.04	0.00	2.75	2.75
Pneumonia	1.69	0.14	0.56	0.05	8.54	2.85	11.38
Acute ear infection	1.69	0.02	0.56	0.01	7.80	2.60	10.39
Typhoid fever	1.60	0.00	0.53	0.00	11.78	3.93	15.71
Road traffic injuries	1.60	0.06	0.53	0.02	8.09	2.70	10.78
Other oral conditions	1.10	0.00	0.37	0.00	3.76	1.25	5.01
Dental caries	1.10	0.00	0.37	0.00	0.00	0.00	0.00
Diabetes Mellitus	0.83	0.02	0.28	0.01	7.44	2.48	9.92
Total	138.45	1.66	48.78	0.67	581.22	204.73	785.95

For each disease, the number of episodes, hospital admissions and absence days of male and female employees are listed. Further tables contain detailed information concerning calculated work days lost due to death (employee-turnover), as well as information related to presenteeism caused by morbidity and risk factor.

A summary worksheet 'Days Lost Summary' provides an overview and summary of total work days lost caused by morbidity, mortality and presenteesim:

Total Days Lost and Contribution of Morbidity, Mortality and Risk Factors

Days Lost

Disease / Risk Factor	Days Lost Morbidity	Days Lost Presenteeism (due to morbidity)	Days Lost Presenteeism (due to risk factors)	Days Lost Mortality	Total Days Lost per Disease / Risk Factor	Percent of Total Days Lost
Malaria	373.12	161.45	n.a.	8.61	543.18	27.40%
Hypertension	32.93	8.12	196.27	n.a.	237.32	11.97%
Obesity	n.a.	n.a.	111.80	n.a.	111.80	5.64%
HIV/AIDS	n.a.	n.a.	n.a.	140.67	140.67	7.10%
Skin diseases	89.73	22.35	n.a.	n.a.	112.08	5.65%
Physical Inactivity	n.a.	n.a.	63.83	n.a.	63.83	3.22%
Infection upper respiratory tract	64.24	16.03	n.a.	n.a.	80.27	4.05%
Diabetes Mellitus	9.92	2.42	45.56	n.a.	57.90	2.92%
Diarrhoeal diseases	36.76	9.04	n.a.	38.53	84.32	4.25%
Tuberculosis	n.a.	n.a.	n.a.	66.58	66.58	3.36%
Acute eye infections	41.43	10.34	n.a.	n.a.	51.77	2.61%
Tobacco	n.a.	n.a.	61.92	n.a.	61.92	3.12%
Home/occupational injuries	36.50	8.95	n.a.	n.a.	45.45	2.29%
Road traffic injuries	10.78	2.60	n.a.	23.32	36.70	1.85%
Intestinal worms	19.34	4.78	n.a.	n.a.	24.13	1.22%
Cerebrovascular disease	n.a.	n.a.	n.a.	27.90	27.90	1.41%

7.2.5 Calculation of costs

On basis of calculated predicted work days lost, costs are analysed taking total annual salary, number of working days per year and death benefit proportional factor (all specified in the 'Input Parameters' worksheet) into account.

The worksheet 'Calculated Costs in Detail' contains various tables related to the categories of morbidity, mortality and presenteeism providing a detailed overview of costs for male and female employees. The following screenshots shows the table of calculated costs due to sickness:

Costs due to Absence Days (Sickness)

Disease costs due to absence days [GHS]

Disease	*Costs Male Eployees*	*Costs Female Eployees*	Total Costs
Malaria	19'343.78	6'447.93	25'791.71
Infection upper respiratory tract	3'330.38	1'110.13	4'440.51
Diarrhoeal diseases	1'905.58	635.19	2'540.78
Skin diseases	4'651.87	1'550.62	6'202.49
Hypertension	1'707.33	569.11	2'276.44
Home/occupational injuries	1'892.35	630.78	2'523.13
Acute eye infections	2'147.87	715.96	2'863.82
Pregnancy and related complications	0.00	347.26	347.26
Rheumatic and joint diseases	0.00	0.00	0.00
Anaemia	918.35	306.12	1'224.47
Intestinal worms	1'002.90	334.30	1'337.20
Gynaecological conditions	0.00	222.39	222.39
Malaria in pregnancy	0.00	189.88	189.88
Pneumonia	590.18	196.73	786.90
Acute ear infection	538.86	179.62	718.48
Typhoid fever	814.36	271.45	1'085.82
Road traffic injuries	559.12	186.37	745.49
Other oral conditions	259.57	86.52	346.09
Dental caries	0.00	0.00	0.00
Diabetes Mellitus	514.14	171.38	685.52
Total costs	40'176.64	14'151.75	54'328.39

A summary worksheet 'Cost Summary' provides an overview and summary of total costs caused by morbidity, mortality and presenteesim:

Total Costs and Contribution of Morbidity, Mortality and Risk Factors

Total costs [GHS]

Disease / Risk Factor	Costs Morbidity	Costs Presenteeism (due to morbidity)	Costs Presenteeism (due to risk factors)	Costs Mortality	Total Costs per Disease / Risk Factor	Percent of Total Costs
Malaria	25'791.71	11'159.97	n.a.	595.46	37'547.14	27.40%
Hypertension	2'276.44	561.34	13'566.78	n.a.	16'404.56	11.97%
Obesity	n.a.	n.a.	7'727.88	n.a.	7'727.88	5.64%
HIV/AIDS	n.a.	n.a.	n.a.	9'723.47	9'723.47	7.10%
Skin diseases	6'202.49	1'545.22	n.a.	n.a.	7'747.71	5.65%
Physical Inactivity	n.a.	n.a.	4'411.88	n.a.	4'411.88	3.22%
Infection upper respiratory tract	4'440.51	1'107.85	n.a.	n.a.	5'548.36	4.05%
Diabetes Mellitus	685.52	167.46	3'149.13	n.a.	4'002.12	2.92%
Diarrhoeal diseases	2'540.78	624.93	n.a.	2'663.08	5'828.80	4.25%
Tuberculosis	n.a.	n.a.	n.a.	4'602.27	4'602.27	3.36%
Acute eye infections	2'863.82	714.90	n.a.	n.a.	3'578.72	2.61%
Tobacco	n.a.	n.a.	4'280.19	n.a.	4'280.19	3.12%
Home/occupational injuries	2'523.13	618.74	n.a.	n.a.	3'141.87	2.29%
Road traffic injuries	745.49	179.47	n.a.	1'611.98	2'536.93	1.85%
Intestinal worms	1'337.20	330.63	n.a.	n.a.	1'667.82	1.22%
Cerebrovascular disease	n.a.	n.a.	n.a.	1'928.40	1'928.40	1.41%

7.2.6 Interventions, Costs & Benefits

The worksheet 'Interventions, Costs & Benefits' provides the user with an interface to select various intervention packages for the categories 'Malaria' and 'Non-Acute Diseases & Risk Factors' and 'Acute Diseases'. There are interventions targeted at the whole category of diseases as well as on a specific disease.

When selecting a specific intervention package (e.g. MAL-1 ITN) the annual costs of intervention, the annual benefit as well as the cost-benefit ratio and net benefit are calculated. In addition, the user can specify values for intervention coverage, annual costs of intervention package and estimated reduction of incidence and mortality rate respectively:

Intervention Type	Intervention Coverage	Description	Intervention Duration	Annual Cost per Employee	Reduction in Incidence /	Reduction in Mortality [%]
MAL-1: Insecticide-treated bednets (ITN)	100.0%	Providing Long-lasting insecticide treated bednets (LLIN) for each employee's family average 4 LLIN @ GHS10,00	3	13.33	50.0%	20.0%

Based on these user inputs, the predicted impact of the intervention on work days lost is calculated. The following screenshot provides an example of the calculation of the cost-benefit ratio and net benefit when choosing MAL-1 ITN as an intervention against malaria:

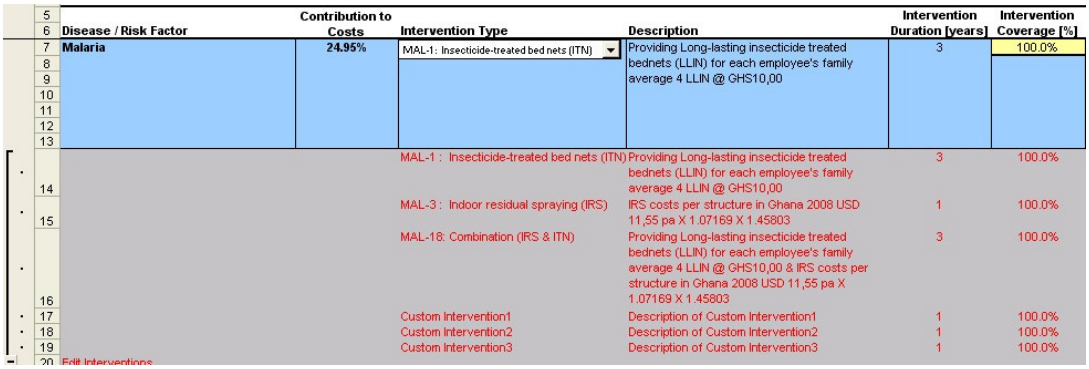
Annual Cost of Intervention	Annual Benfit [GH	Cost / Benefit Rat	Net Benefit [GH
13'330.00	18'594.93	0.7169	5'264.93

When the values of the input parameters are changed, a flag is displayed to indicate that the user is about to perform a sensitivity analysis. The baseline values for each intervention package are summarized in the 'Sensitivity Analysis' section:

Sensitivity analysis, baseline values are:
100%;13.33;50%;20% (MAL-1)
100%;18.05;50%;20% (MAL-3
100%;31.38;71%;29% (MAL-18)

In addition to predefined interventions a set of three custom interventions can be specified for each category and disease. By ungrouping the 'Edit Interventions' section (pressing the + button on the left side of the worksheet below the specific category or disease respectively) the values of the custom interventions like description, duration, coverage, annual costs per

employee (taking into account that certain interventions are targeted at sex-specific conditions), reduction in incidence and mortality can be adjusted.



Disease / Risk Factor	Contribution to Costs	Intervention Type	Description	Intervention Duration [years]	Intervention Coverage [%]
Malaria	**24.95%**	MAL-1: Insecticide-treated bed nets (ITN)	Providing Long-lasting insecticide treated bednets (LLIN) for each employee's family average 4 LLIN @ GHS10,00	3	100.0%
		MAL-1 : Insecticide-treated bed nets (ITN)	Providing Long-lasting insecticide treated bednets (LLIN) for each employee's family average 4 LLIN @ GHS10,00	3	100.0%
		MAL-3 : Indoor residual spraying (IRS)	IRS costs per structure in Ghana 2008 USD 11,55 pa X 1.07169 X 1.45803	1	100.0%
		MAL-18: Combination (IRS & ITN)	Providing Long-lasting insecticide treated bednets (LLIN) for each employee's family average 4 LLIN @ GHS10,00 & IRS costs per structure in Ghana 2008 USD 11,55 pa X 1.07169 X 1.45803	3	100.0%
		Custom Intervention1	Description of Custom Intervention1	1	100.0%
		Custom Intervention2	Description of Custom Intervention2	1	100.0%
		Custom Intervention3	Description of Custom Intervention3	1	100.0%

Edit Interventions

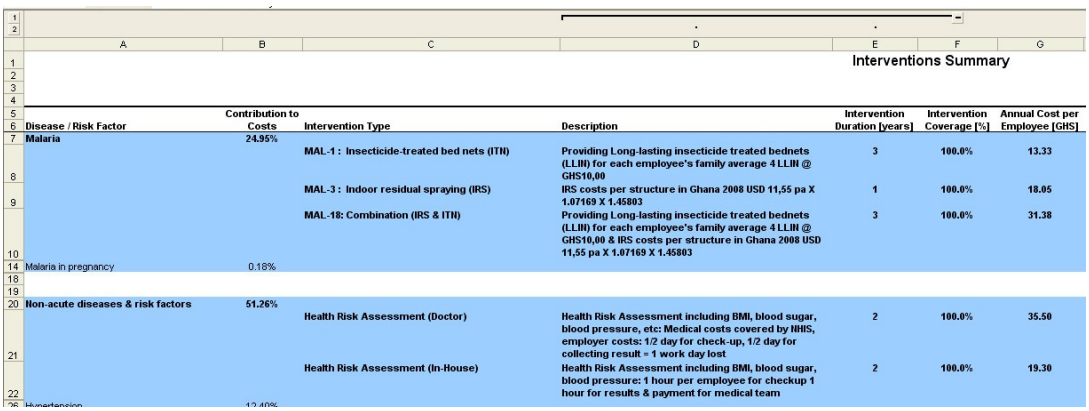
The default values of predefined interventions can be changed as well.

As soon as the default values have been adjusted, these values are now used for calculation when selecting a specific intervention in the selection list of a disease or category.

The diseases in the three categories are sorted according to their relative contribution to total costs (that means changing the proportion of male/female employees in the 'Input Parameters' worksheet potentially has an impact on this order).

The worksheet 'Interventions Summary' provides a list of all interventions and a predicted cost-benefit ratio for all categories and diseases. All interventions which have an impact on employee health (through a reduction in incidence/prevalence > 0 or reduction in mortality > 0) are shown, the others are hidden.

As soon as the user changes some default values of custom (or predefined) interventions in the 'Interventions, Costs & Benefit' worksheet, the 'Interventions Summary' worksheet is instantly updated.



Interventions Summary

Disease / Risk Factor	Contribution to Costs	Intervention Type	Description	Intervention Duration [years]	Intervention Coverage [%]	Annual Cost per Employee [GHS]
Malaria	**24.95%**					
		MAL-1 : Insecticide-treated bed nets (ITN)	**Providing Long-lasting insecticide treated bednets (LLIN) for each employee's family average 4 LLIN @ GHS10,00**	**3**	**100.0%**	**13.33**
		MAL-3 : Indoor residual spraying (IRS)	**IRS costs per structure in Ghana 2008 USD 11,55 pa X 1.07169 X 1.45803**	**1**	**100.0%**	**18.05**
		MAL-18: Combination (IRS & ITN)	**Providing Long-lasting insecticide treated bednets (LLIN) for each employee's family average 4 LLIN @ GHS10,00 & IRS costs per structure in Ghana 2008 USD 11,55 pa X 1.07169 X 1.45803**	**3**	**100.0%**	**31.38**
Malaria in pregnancy	0.18%					
Non-acute diseases & risk factors	**51.26%**					
		Health Risk Assessment (Doctor)	**Health Risk Assessment including BMI, blood sugar, blood pressure, etc: Medical costs covered by NHIS, employer costs: 1/2 day for check-up, 1/2 day for collecting result = 1 work day lost**	**2**	**100.0%**	**35.50**
		Health Risk Assessment (In-House)	**Health Risk Assessment including BMI, blood sugar, blood pressure: 1 hour per employee for checkup 1 hour for results & payment for medical team**	**2**	**100.0%**	**19.30**
Hypertension	12.40%					

7.2.7 Epidemiological data, hospital stays, risk factors, disease duration and disability weights

This section of the workbook contains various worksheets that hold epidemiological data, data related to hospital stays and proportion of in-patients and outpatients morbidity as well as tables summarizing specific data related to disease duration and disability weights.

The following screenshot shows the epidemiological profile and the top twenty causes of outpatient morbidity contained in the 'Epidemiological Profile' worksheet:

Top Twenty Causes of Outpatient Morbidity and Relative Proportion of Hospital Admissions

Disease	Incidence Males*	Incidence Females*	Relative Proportion In/Outpatie	Comments	Reference
Malaria	0.106	0.106	0.01098	Population >= 5 years of age	D
Infection upper respiratory tract	0.016	0.016	0.00205		B
Diarrhoeal diseases	0.010	0.010	0.01615	Hospital admissions based on data for 'Gastroenteritis'	B
Skin diseases	0.010	0.010	0.00348		B
Hypertension	0.007	0.007	0.01365		B
Home/occupational injuries	0.005	0.005	0.01910		B
Acute eye infections	0.005	0.005	0.00148		B
Pregnancy and related complications	0.000	0.005	0.03375		B
Rheumatic and joint diseases	0.005	0.005	0.00000	No data available for hospital admissions	B
Anaemia	0.004	0.004	0.06251		B
Intestinal worms	0.004	0.004	0.01098	Hospital admissions based on data for 'other disease digestive tract'	B
Gynaecological conditions	0.000	0.003	0.05276	Hospital admissions based on data for 'complicated pregnancy'	B
Malaria in pregnancy	0.000	0.003	0.06176	Hospital admissions based on data for 'complicated pregnancy'	B
Pneumonia	0.002	0.002	0.08315		B
Acute ear infection	0.002	0.002	0.01098		B
Typhoid fever	0.002	0.002	0.00199		B
Road traffic injuries	0.002	0.002	0.03705		B
Other oral conditions	0.001	0.001	0.00069		B
Dental caries	0.001	0.001	0.00000	No data available for hospital admissions	B
Diabetes Mellitus	0.001	0.001	0.02287		B

Similarly, the leading causes of death are summarized in the table below:

Leading Causes of Death Males / Females

Disease	Gender	Estimated deaths in '000	Percentage of Total	Mortality Rate	Comments	Reference
HIV/AIDS	Male	7.68	19.6%	1.21984E-03	Age: 15-59 years	E, H
Tuberculosis	Male	4.57	11.7%	7.26106E-04	Age: 15-59 years	E, H
Diarrhoeal diseases	Male	2.26	5.8%	3.59403E-04	Age: 15-59 years	E, H
Tropical-cluster diseases	Male	1.71	4.4%	2.71637E-04	Age: 15-59 years	E, H
Ischaemic heart disease	Male	1.64	4.2%	2.60917E-04	Age: 15-59 years	E, H
Cerebrovascular disease	Male	1.61	4.1%	2.56012E-04	Age: 15-59 years	E, H
Violence	Male	1.59	4.1%	2.52210E-04	Age: 15-59 years	E, H
Road traffic accidents	Male	1.55	4.0%	2.46736E-04	Age: 15-59 years	E, H
Other unintentional injuries	Male	1.25	3.2%	1.98639E-04	Age: 15-59 years	E, H
Lower respiratory infections	Male	1.21	3.1%	1.91582E-04	Age: 15-59 years	E, H
Malaria	Male	0.50	1.3%	7.93970E-05	Age: 15-59 years	E, H
HIV/AIDS	Female	9.61	24.6%	1.52632E-03	Age: 15-59 years	E, H
Maternal conditions	Female	3.78	9.7%	5.99836E-04	Age: 15-59 years	E, H
Diarrhoeal diseases	Female	2.15	5.5%	3.42101E-04	Age: 15-59 years	E, H
Tuberculosis	Female	1.74	4.4%	2.76228E-04	Age: 15-59 years	E, H
Cerebrovascular disease	Female	1.64	4.2%	2.60444E-04	Age: 15-59 years	E, H
Tropical-cluster diseases	Female	0.95	2.4%	1.51294E-04	Age: 15-59 years	E, H
Ischaemic heart disease	Female	0.95	2.4%	1.51178E-04	Age: 15-59 years	E, H
Breast cancer	Female	0.76	2.0%	1.21355E-04	Age: 15-59 years	E, H
Road traffic accidents	Female	0.75	1.9%	1.19516E-04	Age: 15-59 years	E, H
Other unintentional injuries	Female	0.62	1.6%	9.86444E-05	Age: 15-59 years	E, H
Malaria	Female	0.50	1.3%	7.93889E-05	Age: 15-59 years	E, H

The 'Risk Factors' worksheet summarizes the most relevant risk factors and the estimation of annual unproductive days.

Risk	Gender	Prevalence	Annual unproductive days*	Percent above no risk
Tobacco	Male	0.073	1.118	224
	Female	0.002	1.377	238.1
Alcohol	Male	0.016	1.118	224.0
	Female	0.015	1.377	238.1
Diet	Male	0.005	0.609	146.2
	Female	0.007	0.734	121.6
Physical Inactivity	Male	0.079	0.609	146.2
	Female	0.151	0.734	121.6
Hypertension	Male	0.317	0.609	146.2
	Female	0.280	0.734	121.6
Obesity	Male	0.100	0.609	146.2
	Female	0.360	0.734	121.6
Diabetes	Male	0.078	0.609	146.2
	Female	0.054	0.734	121.6

* Includes extra days of presenteeism due to presence of risk factor adjusted for actual days worked per year as Novartis figures based on 260 work days per annum

The 'Hospital Stays' worksheet contains a table summing up the estimated duration of hospital stays for the top twenty causes of morbidity:

Stay in Hospital - Top Twenty Causes of Morbidity

Disease	Average length of stay in hospital [days]	Comments	Reference
Malaria	3.2		A
nfection upper respiratory tract	3.6		A
Diarrhoeal diseases	3.4	Based on data for 'gastroenteritis'	A
Skin diseases	8.3		A
Hypertension	4.3		A
Home/occupational injuries	6.2		A
Acute eye infections	7.1		A
Pregnancy and related complications	3.8		A
Rheumatic and joint diseases	0	No data available	A
Anaemia	4		A
ntestinal worms	4.7	Based on data for 'other disease digestive tract'	A
Gynaecological conditions	3.8	Based on data for 'complicated pregnancy'	A
Malaria in pregnancy	3.8	Based on data for 'complicated pregnancy'	A
Pneumonia	4.6		A
Acute ear infection	4.2		A
Typhoid fever	6.7		A
Road traffic injuries	4.6		A
Other oral conditions	3.1		A
Dental caries	0	No data available	A
Diabetes Mellitus	8.1		A

The 'Duration and Disability Weights' sheet provides an overview of disease durations and disability weights for the top twenty causes of morbidity:

Disease	Average disease duration [years]	Average disease duration [days]	Reference
Malaria	0.01	3.65	C
Infection upper respiratory tract	0.01	3.65	C
Diarrhoeal diseases	0.02	7.3	C
Skin diseases	n.a.	n.a.	C
Hypertension	n.a.	n.a.	C
Home/occupational injuries	n.a.	n.a.	C
Acute eye infections	n.a.	n.a.	C

Disability weights for untreated forms	Disablility weights for treated forms	Above Threshold (>0.05)	Reference
0.172	0.172	yes	F
0.07	0.07	yes	F
0.086	0.086	yes	F
0.045	0.045	no	F
n.a.	n.a	n.a.	F
n.a.	n.a	n.a.	F

7.2.8 Various information and WHO CHOICE reference sheet

The last section of the Excel tool provides further information related to hospital treatment costs and the WHO-CHOICE initiative. The 'Hospital Treatment' sheet summarizes average costs per treatment for the top twenty causes of morbidity:

Disease	Average cost per treatment [old Cedis, 2003]	Comments	Reference
Malaria	104327.63		A
Infection upper respiratory tract	120056.05		A
Diarrhoeal diseases	121979.17	Based on data for 'gastroenteritis'	A
Skin diseases	356429.32		A
Hypertension	161252.07		A
Home/occupational injuries	286775.92		A
Acute eye infections	162680.57		A
Pregnancy and related complications	198269.73		A
Rheumatic and joint diseases	0	No data available	A
Anaemia	159957.6		A
Intestinal worms	267256.01	Based on data for 'other disease digestive tract'	A
Gynaecological conditions	198269.73	Based on data for 'complicated pregnancy'	A
Malaria in pregnancy	198269.73	Based on data for 'complicated pregnancy'	A
Pneumonia	169688.68		A
Acute ear infection	120078.17		A
Typhoid fever	385834.76		A
Road traffic injuries	255103.85		A
Other oral conditions	90761.11		A
Dental caries	0	No data available	A
Diabetes Mellitus	407710.05		A

The 'WHO-CHOICE Interventions' sheet provides further information and links to statistics and tools about various intervention types.

7.3 Appendix 3: Tables

	Company/ Agency	RAGB	Customs/CEPS	VAT	IRS	GC-Net	Ghana Water Co. Ltd.	AVRL	GIZ ReCHT	GIZ Country Office	GIZ Other Programs
	Information required										
1	Annual staff strength, number of staff members each year disaggregated by sex	2008 - 2010	2007 - 2010	2007 - 2010	2009-2011	2007 - 2010	none	none	none	2008 - 2010	none
2	Annual total in new Ghana Cedis (GHS) for staff medical expenses	2003 - 2010	2005 - 2010	2006 - 2010 part	2002-2010	2006 - 2010	none	none	none	none	none
3	Annual number of medical claims for reimbursement made	2009 - 2010	none	2006 - 2010	none	none	none	none	none	none	none
4	Annual total in GHS of salaries expense	2007 - 2010	2007 - 2010	2007 - 2010	2007-2010	none	none	none	none	none	none
5	Annual total number of sick leave days disaggregated by sex	2006, 2010	none	2007 - 2010	none	2010	none	none	none	2008 - 2010	none
6	Annual number of staff turnovers due to illness, disability or death disaggregated by sex	none	2007 - 2010	2007 - 2010	2002-2010, 2006 missing	none	none	none	none	none	none
7	Annual number of compassionate leave days	none	none	2008 - 2010	none	2010	none	none	none	none	none
8	Monitoring & Evaluation reports	yes	yes	yes	yes	yes	yes	yes			
9	Semi- and Annual reports	yes	yes	yes	yes	yes	yes	yes			
10	KAP GTZ study report								2005 - 2006	?	
11	Baseline study 2008		2008				2008	2008			
12	HIV/TB study 2008										
13	WPP programme financial reports for programme expenses										
14	EWP programme financial reports for programme expenses										
15	WPP dedicated staff costs										
16	EWP dedicated staff costs										
17	Organisation charts current	yes	yes	yes	yes	yes					
18	Organisation charts previous	yes	yes	yes	yes	n.a.					

Table 13: Summary table of data sets received.