FACT SHEET:
UN OWG Target 3.3 on Infectious Diseases

The United Nations Open Working Group on Sustainable Development Goals (OWG) has proposed target 3.3 for the post-2015 development agenda as follows:

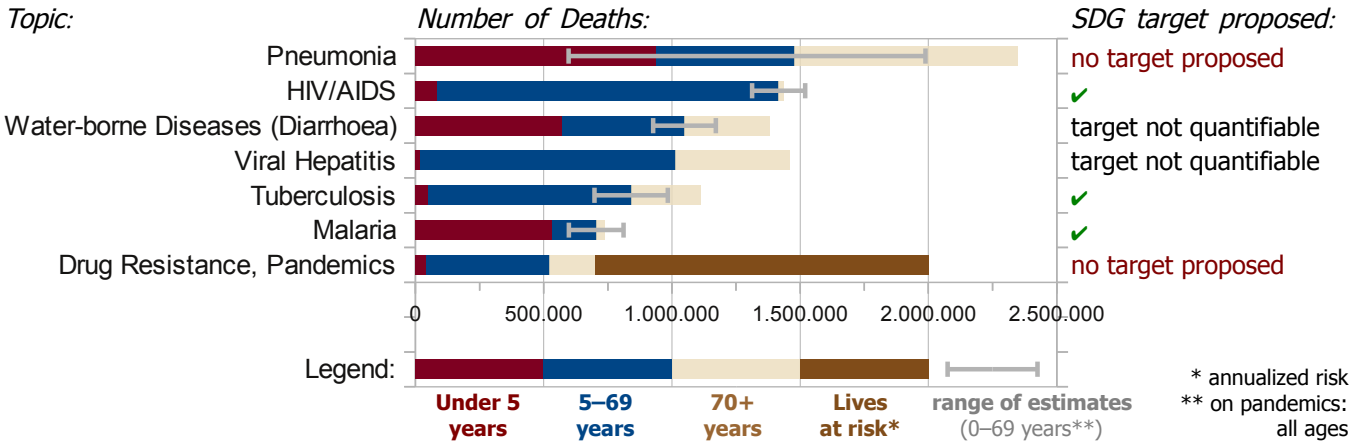
> *By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.*[1]

Since the target strives to end three major epidemics – and covers further diseases – it could, along with target 3.2 (child mortality), be *the SDG target with the greatest impact in terms of reducing mortality*. AIDS, TB and malaria, combined, claim substantially more than 3 million lives per year, and all infectious diseases put together even exceed under-five mortality by far.[2] No other target holds the potential to make a difference to human development for the post-2015 agenda on this scale.

The proposed target is quantifiable and time-bound for HIV/AIDS, tuberculosis and malaria, but not for the further diseases included. For the targets, we have "to ensure that each is framed in language that is specific, measurable, achievable" (UN SG).[3] Mortality data confirms the importance of AIDS, TB and malaria, but shows that *pneumonia, diarrhoeal diseases, hepatitis, resistance and pandemics* are just as relevant; they deserve a time-bound and quantified target just as much as the former MDG topics.

The Biggest Killers Among the Infectious Diseases

Order of Topics According to the Annual Number of Deaths at below Global Life Expectancy (70 Years)



Data sources: Global Burden of Disease (GBD) study 2015; WHO 2014; RAM [UK] 2014, Murray et al.; McKibbin et al.; Taubenberger et al.; Osterholm, i.a.; tropical diseases except malaria caused 142 000 deaths in 2013 (GBD 2015).[4]

1) Pneumonia

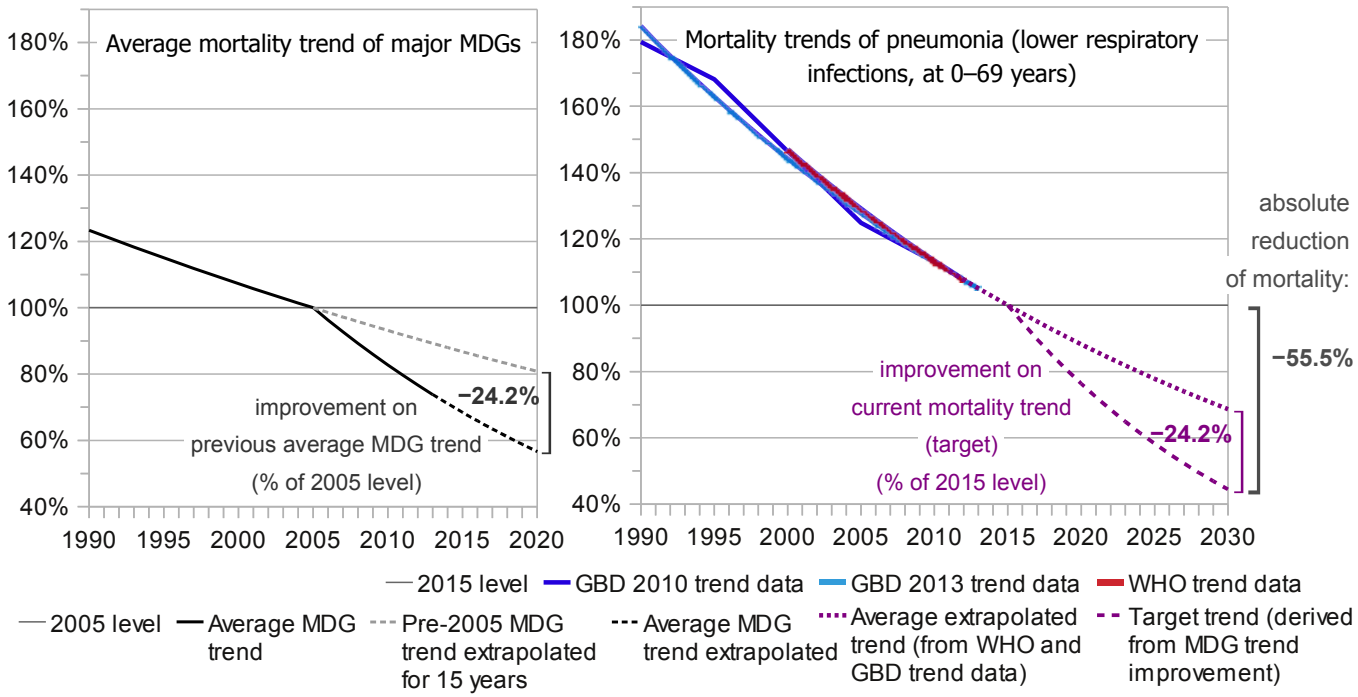
Pneumonia is the biggest infectious child-killer, claiming between 414 000 and 1.3 million lives of children under five per year (GBD; WHO; Liu et al.; Fischer Walker et al.).[5] It is also likely the biggest infectious killer in total, while for people under 70 years the severity is similar to AIDS (see diagram on p. 1). However, misdiagnoses and data issues lead to very different estimates. If current trends continue, pneumonia would remain the biggest infectious killer (unless it is surpassed by viral hepatitis).[6]

Affected people: Approximately *156 million children* contracted pneumonia in 2000, while lower respiratory infections (mainly pneumonia) affected *429 million people* in 2004 (6.69%) (Rudan; WHO).[7]

Target by the World Health Assembly: in children under five, to reduce mortality from pneumonia by 65% and to reduce the incidence of severe pneumonia by 25% by 2015, using 2000 as a baseline.[8]

The *aspiration* of the SDGs should at least be equivalent to the achievements of the MDGs. Therefore, a SDG target on pneumonia should improve on current trends by 24.2% (between 2015 and 2030):

Trends in Numbers of Deaths: MDGs Average, Pneumonia, and Target Trend



Data sources: WHO 2014, 2013; GBD 2014; IHME [GBD] 2013;[9] for the MDG trends: WHO; IHME [GBD]; UNICEF.[10]

The target is derived from the average trend improvement achieved by the MDGs, according to the trends before/after 2005 in number of deaths due to the MDG topics of HIV/AIDS, tuberculosis, malaria, undernutrition (in childhood), diarrhoeal diseases (related to unsafe water), maternal conditions and under-5 mortality: From 2005 to 2013, the MDGs improved on their previous trends by 15.4% of the 2005 level (percentage points). For a 15-year period, this equals 24.2% (assuming an exponential decrease, which results in a more moderate reduction than a linear decrease would do).[11]

Hence, target 3.3 should state: "By 2030, … improve on the current trends in the number of premature deaths from pneumonia by one quarter …" If the target is not to accommodate different country trends, it could set an absolute target: "… halve the number of premature deaths from pneumonia").[12]

2) Water-borne Diseases

Most deaths from water-borne diseases are caused by *diarrhoeal diseases*, which include infections such as those arising from rotavirus, *E.coli,* salmonella and cholera,[13] transmitted mainly through contaminated water.[14] Since target 3.3 is quantifiable for malaria and other tropical water-borne diseases, these are not being addressed in the following.

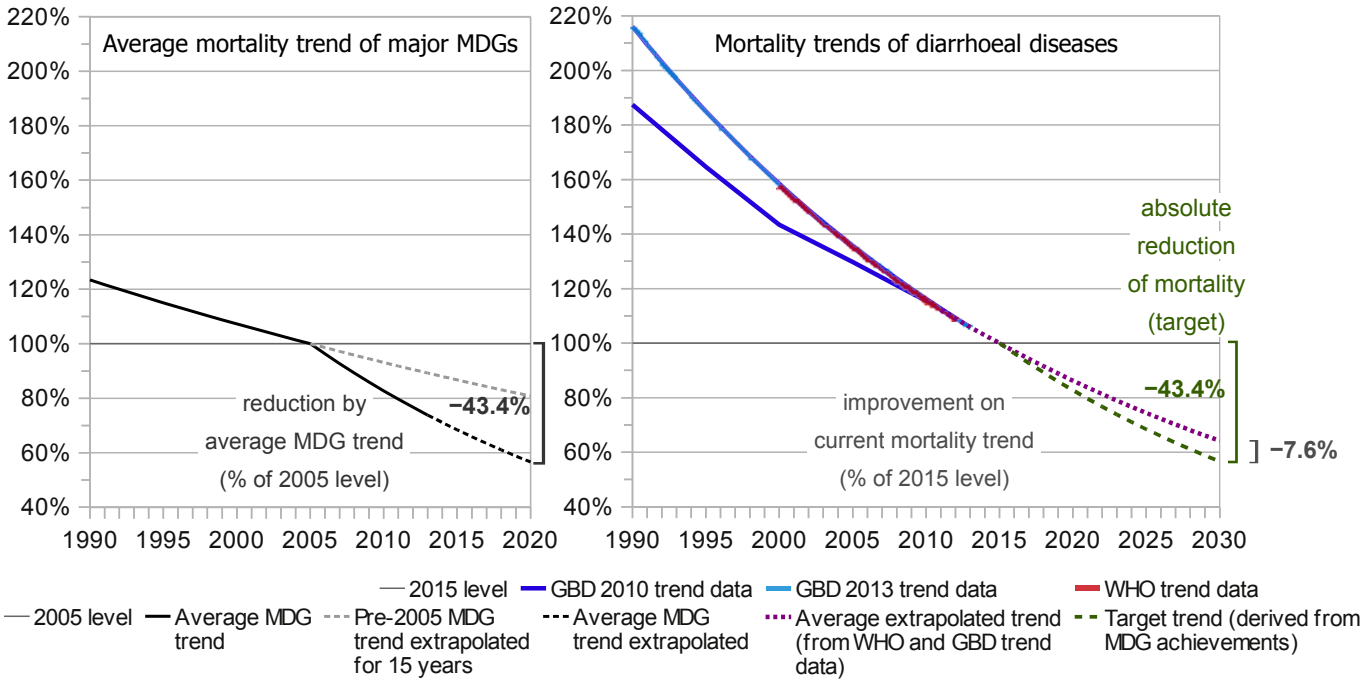
Diarrhoeal diseases are also related to target 3.9, which is hard to quantify (to "substantially reduce" mortality from water pollution).[15] However, the following information and recommendation could be applied to target 3.9 as well as to target 3.3.

Diarrhoeal diseases *killed 1.26–1.50 million people* in 2012/13, similarly to TB or AIDS (GBD; WHO).[16]

Affected people: Among children under five, approximately *36 million severe cases* of diarrhoea occurred in 2010 (Fischer-Walker et al.).[17] In total, there are nearly 1.7 billion cases per year (WHO).[18]

Water-borne diseases are related to the MDG topic of safe water and should continue with the MDG achievements. Hence, a target on water-borne diseases should aim for a reduction of 43.4% by 2030:

Trends in Numbers of Deaths: MDGs Average, Diarrhoeal Diseases, and Target Trend



Data sources: WHO 2014, 2013; GBD 2014; IHME [GBD] 2013;[19] for the MDG trends: WHO; IHME [GBD]; UNICEF.[10]

The target is derived from the average *absolute* achievements by the MDGs: a reduction in the numbers of death by 26.2% between 2005 and 2013, which represents 43.4% over a 15-year period (for details, see info box on p. 2).[20]

Therefore, target 3.3 should include an extension related to a 43% reduction: "By 2030, … reduce the number of deaths from water-borne diseases by two fifths, …" However, such an absolute reduction target cannot accommodate different country trends and conditions.[21] Alternatively, a trend-related target could be defined (equalling 7.6% for 2015–30[22]): "By 2030, … improve on the current trends in the number of deaths from water-borne diseases by one tenth, …"

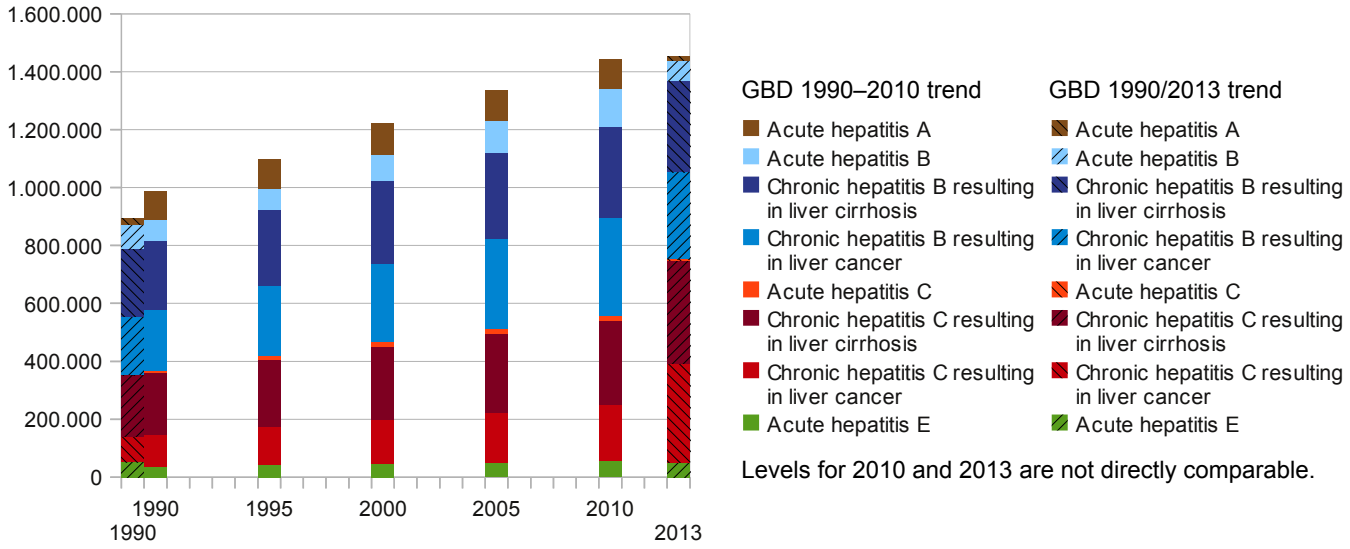
3) Hepatitis

Not only has viral hepatitis claimed a *death toll of 1.46 million* in 2013, similar to HIV/AIDS (GBD),[23] but it is rather the only million-killer among the infectious diseases with mortality still increasing. This will make hepatitis *the biggest epidemic of the post-2015 era* if current trends continue.[24]

Affected people: Each year, approximately *4.4 million cases of acute hepatitis A or E* occur (WHO).[25] *Chronic hepatitis B or C affects between 370 and 410 million people* (WHO; Lavanchy [WHO]).[26] These constitute 5.38–5.97% of the world's population.[27] The number of people carrying a hepatitis C infection increased by about 51.6% from 1990 to 2005 (Mohd Hanafiah).[28]

Target by the World Health Assembly (related to hepatitis B only): to reduce global childhood morbidity and mortality due to vaccine-preventable diseases by at least two thirds, from 2000 to 2015.[29] The extended use of the vaccine for hepatitis B may have helped to reduce acute hepatitis B in 2013:[30]

Trends in Numbers of Deaths from Viral Hepatitis



Data sources: GBD 2015 (on 1990 and 2013); IHME [GBD] 2013 (on 1990, 1995, 2000, 2005, 2010).[31]

The data shows that deaths from viral hepatitis increased over a 15-year period by 31.3–37.3%.[32] Halting this increase would be more ambitious than the average trend change achieved by the MDGs (24.2%).[11] It would require the same level of effort as was needed and is needed for HIV/AIDS. Moreover, there is a *substantial inertia or time-lag* to consider: Since most deaths occur decades after infection due to chronic disease, hepatitis B and C are projected to become a higher ranked global cause of death over the next two decades (WHO).[33] Hepatitis is therefore called a "viral time-bomb" (WHO).[34] The time-lag could be considered in a target on hepatitis by aiming to only slow down the increase in mortality by 2030. We could also strive to halt the increase of new infections; however, that would require establishing an according monitoring of hepatitis (as an element of the "data revolution").

For these reasons, SDG target 3.3 should include a specification as follows: "By 2030, … halt the increase in new infections and slow down the increase of deaths from hepatitis …"

4) Antimicrobial Resistance, Emerging Diseases and Pandemics

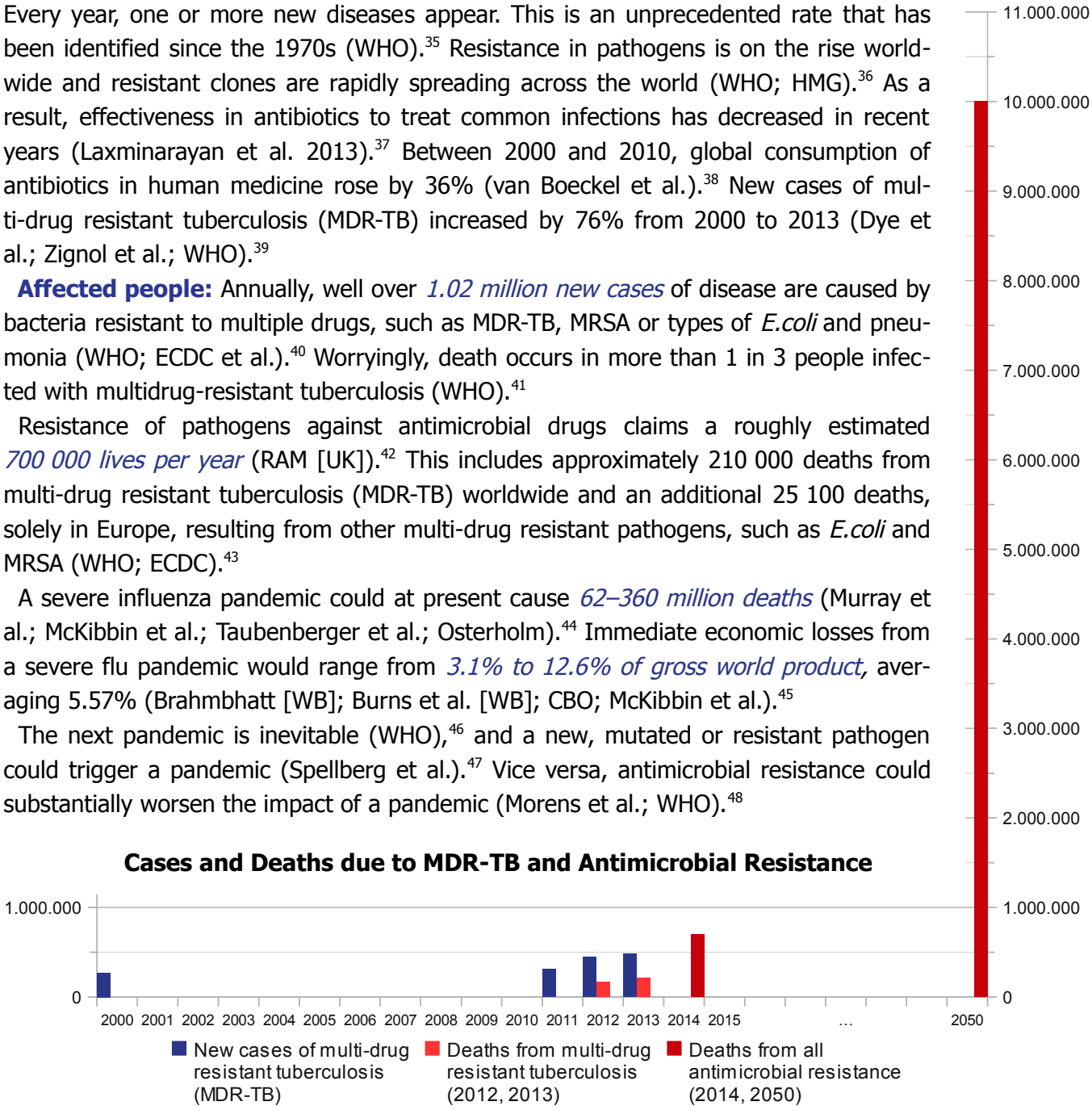
Every year, one or more new diseases appear. This is an unprecedented rate that has been identified since the 1970s (WHO).[35] Resistance in pathogens is on the rise worldwide and resistant clones are rapidly spreading across the world (WHO; HMG).[36] As a result, effectiveness in antibiotics to treat common infections has decreased in recent years (Laxminarayan et al. 2013).[37] Between 2000 and 2010, global consumption of antibiotics in human medicine rose by 36% (van Boeckel et al.).[38] New cases of multi-drug resistant tuberculosis (MDR-TB) increased by 76% from 2000 to 2013 (Dye et al.; Zignol et al.; WHO).[39]

Affected people: Annually, well over *1.02 million new cases* of disease are caused by bacteria resistant to multiple drugs, such as MDR-TB, MRSA or types of *E.coli* and pneumonia (WHO; ECDC et al.).[40] Worryingly, death occurs in more than 1 in 3 people infected with multidrug-resistant tuberculosis (WHO).[41]

Resistance of pathogens against antimicrobial drugs claims a roughly estimated *700 000 lives per year* (RAM [UK]).[42] This includes approximately 210 000 deaths from multi-drug resistant tuberculosis (MDR-TB) worldwide and an additional 25 100 deaths, solely in Europe, resulting from other multi-drug resistant pathogens, such as *E.coli* and MRSA (WHO; ECDC).[43]

A severe influenza pandemic could at present cause *62–360 million deaths* (Murray et al.; McKibbin et al.; Taubenberger et al.; Osterholm).[44] Immediate economic losses from a severe flu pandemic would range from *3.1% to 12.6% of gross world product*, averaging 5.57% (Brahmbhatt [WB]; Burns et al. [WB]; CBO; McKibbin et al.).[45]

The next pandemic is inevitable (WHO),[46] and a new, mutated or resistant pathogen could trigger a pandemic (Spellberg et al.).[47] Vice versa, antimicrobial resistance could substantially worsen the impact of a pandemic (Morens et al.; WHO).[48]



Data sources: Dye et al.; Zignol et al.; WHO; RAM [UK] (on 2050, if no further action is taken).[49]

No international target exists, but revised International Health Regulations aim "to prevent ... the international spread of disease".[50] The recent and ongoing Ebola outbreak in Western Africa revealed lack of regional and global safety and preparedness regarding emerging diseases.[51]

These major health risks could be addressed by extending target 3.3: "By 2030, … halt the increase in deaths from antimicrobial resistance and raise preparedness for emerging diseases and pandemics …"

5) Summarized Recommendation for Target 3.3

Altogether, target 3.3 could be extended as follows (extensions marked in blue):

> *By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases, improve on the current trends in the number of premature deaths from pneumonia by one quarter and from water-borne diseases by one tenth, halt the increase in new infections and slow down the increase in deaths from hepatitis, halt the increase in deaths from antimicrobial resistance and raise preparedness for emerging diseases and pandemics, and combat other communicable diseases.*

The trend-related targets on pneumonia and water-borne diseases accommodate different country trends and conditions.[52] If this is not desired, absolute reductions could be defined instead (which equal figures of 55.5% for pneumonia or 43.4% for water-borne diseases, respectively [2015–30][53]):

> *… reduce the number of premature deaths from pneumonia by half and from water-borne diseases by two fifths, …*

Annotations

For numeric names the short scale is used: 1 billion = one thousand million = 10^9 = 1 000 000 000.

All numbers are shown to three significant digits, if available (no matter if and where the decimal point may appear). This keeps the rounding error below ±0.5%. Nevertheless, all calculations are based on unrounded numbers.

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1 OWG 2014, p. 9 (goal 3, target 3.3).

2 GBD 2015, 131–133: 8.79 million deaths from communicable diseases in 2013 ("HIV and tuberculosis", "Diarrhoea, lower respiratory infections and other common infectious diseases", "Neglected tropical diseases and malaria", "Sexually transmitted diseases excluding HIV", "Hepatitis" [only acute forms], "Other infectious diseases"; sum: review's calculation).
WHO 2014, sheet "Global2012": 12.1 million deaths from infectious diseases in 2012 ("Infectious and parasitic diseases" [only including acute forms of hepatitis], "Respiratory infections").
Under-five mortality is estimated at 6.28–6.29 million deaths of children under five in 2013 (GBD 2015, 140 [table 3: 2.61 million deaths among neonates age <1 month and 3.67 million among children age 1–59 months in 2013; sum: review's calculation]; UNICEF 2014a, 98 [Number of under-five deaths, World: 6.285 million in 2013]).

3 UN SG 2014, § 137.

4 General sources: GBD 2015, 131–135, and GBD 2014 (on deaths in 2013; on viral hepatitis, acute and chronic types were included); WHO 2014, sheet "Global2012" (on deaths in 2012; the WHO figure on AIDS deaths in 2012 is very similar to the latest UNAIDS figure on 2013).
Topic-specific sources: on under-five deaths from pneumonia also: Liu et al. 2015, 3 (on 2013), and Fischer-Walker et al. 2013 (on 2011); on antimicrobial resistance only: RAM [UK] 2014, 5 (age-distribution is taken from tuberculosis [WHO 2014, sheet "Global2012"; review's calculations], since MDR-TB is the main contributor); on a severe pandemic only: Murray et al. 2006, 221, 2214; McKibbin et al. 2006, 15, 26, 57 (two scenarios: "severe" and "ultra"); Taubenberger et al. 2006, 15, 21; Osterholm 2005, 1824; the estimates range from 62 to 180–360 million deaths, and the mean of the 5 estimates is 129 million (review's calculation); assuming a severe influenza similar to the 1918 "Spanish flu" to be a once-in-a-century event leads to an annualized figure of having 1.29 million lives at risk (all age-groups), which is depicted in the diagram (review's calculation).
For more details, see our previous proposal, Global2015 2015, 18–20.
The diagram includes global challenges with the highest number of deaths due to limited access to vital resources such as food, clean water or health care (as far as data is available).
The order of topics is determined by the level of impact in terms of death on people aged under 70 years, since the global life expectancy was 70 years in 2012 (WHO 2014g, life expectancy at birth, both sexes, global, 2012), and mortality at younger ages is considered a better indicator here for the severity of an issue than total mortality. It makes a difference whether people die at child age, at middle age (which has low mortality rates), or at high age (with high mortality rates anyway). However, this does not imply that mortality at higher ages should not be taken seriously. Therefore, data on all age groups is provided.
On tropical diseases except malaria: GBD 2015, 132; review's calculation.

5 Latest estimates on under-five mortality from pneumonia:
- 414 000 deaths in 2013 due to the three most common types of pneumonia (GBD 2015, 146 [table 4]; sum: review's calculation), not including all types of pneumonia and not including deaths under the age of one month (p. 126)
- 935 000 deaths in 2013 (95% uncertainty range 817 000 to 1.06 million), including deaths in neonates aged 0–27 days (Liu et al. 2015, 432 [table, annotations; results]; WHO 2014a)
- 1.3 million deaths in 2011, including neonatal deaths (Fischer Walker et al. 2013; data used for the study was extracted from the Child Health Epidemiology Reference Group [CHERG] [see its appendix]).

6 For viral hepatitis and other major contagious diseases (as shown in the diagrams on p. 1), see trend data in IHME [GBD] 2013 (on 1990, 1995, 2000, 2005 and 2010) and GBD 2015, 131 (table 2), "All ages deaths (thousands)", "Median % change" (between 1990 and 2013).

7 Latest available data: Rudan et al. 2008 (156 million new episodes of pneumonia in 2000, only covering children under five); WHO 2008, 28 (table 5) (429 million people in 2004 affected by lower respiratory infections), 14, 111 (mainly pneumonia); percentage of the world's population: review's calculation from the WHO figure, using WB 2014, world, 'Population (Total)', 2004 (6.41 billion).

8 WHO et al. 2009, 3; WHO 2010a (resolution of the World Health Assembly), §1 (5). According to the GBD study, the number of under-five deaths from lower respiratory infections (mainly pneumonia) decreased from 847 000 in 2000 to 1.35 million in 2010, or by 37.0% (IHME [GBD] 2013, search term "LRI Deaths by Year by Age"; percentage: review's calculation). According to the WHO Global Health Estimates, the figure decreased from 1.67 million in 2000 to 995 000 in 2012, or by 40.3% (WHO 2014, sheets "Global2000" and "Global2012"; percentage: review's calculation). Therefore, progress is not on track for the target to be met.

9 Since no trend data series on pneumonia is available, lower respiratory infections – which consist mainly of pneumonia – were taken as a proxy; age groups 0–69 years only (due to the high proportion of pneumonia deaths at 70+); GBD 2010 trend data: IHME [GBD] 2013, search term: "by age by year Global LRI" (1990, 1995, 2000, 2005, 2010); GBD 2013 trend data: GBD 2014, Lower respiratory infections (1990, 2013); WHO trend data: WHO 2014, sheets "Global2000" and "Global2012" (2000, 2012).
In the diagram, the absolute figures have been indexed to 100% in 2015, according to the exponential extrapolation of their average trend (review's calculations). The trends of available WHO and GBD data were averaged and extrapolated as follows:
For each trend series an exponential regression was calculated (least square method), resulting in an annual rate of change of −2.21% for the GBD 2010 data (only the latest trend 2005–2010 was taken into account), −2.50% for the GBD 2013 data (1990–2013) and −2.72% for the WHO data (2000–2012). From these annual rates the exponential change over the 15-year period from 2015 to 2030 was derived, leading to a decrease of 28.4% for the GBD 2010 data, 31.6% for the GBD 2013 data and 33.9% for the WHO data. Example for the annual −2.50% rate: $(1 + (-2.5 / 100))^{15} - 1 = -0.316 = -31.6\%$. The 3 trend results for 2030

were averaged to a mean of 31.3% (of the 2015 level; percentage points), which represents an annual average rate of change of 2.48%; review's calculations, $((1 + -0.3134) / 1)^{(1 / 15)} - 1 = 2.48\%$. This is depicted in the diagram as the average extrapolated trend (from WHO and GBD data).

This trend was depicted in the diagram as the average extrapolated trend (from WHO and GBD data). It also serves as the base trend for applying the desired trend improvement of 24.2%, as achieved on average by the MDGs.

It should be noted that the extrapolation of current trends by 2030 is only provided for the ease of visualization. The approach to derive a target level from the average MDG trend improvement does not require using or creating any future projection. The target level is based on current trends or on trends before 2015. No trends for the target period 2015–2030 need to be known and thus available future projections from the WHO have not been used (WHO 2013, sheets "World2015" and "World2030").

10 Annual exponential change rates were averaged from WHO, GBD and UNICEF trend data (for a diagram showing the different MDG trends, and further details, see our latest proposal: Global2015 2015, 3):

- HIV/AIDS: WHO 2014c (tabular data); global sums: review's calculations.
- Tuberculosis: WHO 2014d (tabular data); global sums: review's calculations.
- Malaria: WHO 2014e (tabular data), "Global".
- Maternal conditions: WHO 2014f (tabular data) (ZIP archive, file Web release 6 May/2014PublicRelease_code_data/data/outputdata/FinSee note 12 and info box on p 7 above al.estimates/uncertainty.who.region.csv, categories "MatDth", World).
- Undernutrition (in childhood), diarrhoeal diseases: IHME [GBD] 2013, which provides trend data by the GBD study and related diagrams for 1990, 1995, 2000, 2005 and 2010; search terms: "by year Global Deaths Undernutrition", "by year Global Deaths Diarrhea".
- Under-5 mortality: UNICEF 2014 (tabular data), sheet "Regional and Global Estimates", "Estimates of under-five deaths by UNICEF region", World, Median.

From this data the average MDG trend before/after 2005 was calculated, assuming exponential change. The average MDG trend only indicates the trend change before and after 2005; it does not reflect trend changes over the period 1990 to 2005. For the time frame before 2000, UN agencies do not provide mortality data on HIV/AIDS and malaria.

11 The total reductions mentioned here reflect exponential decreases; assuming a linear decrease would lead to much stronger reduction targets. Basing the long-term reduction on annual percentage reductions considers the general issue that after having reached a lower level, the same absolute reduction becomes more difficult to attain (Fukuda-Parr et al. [IPC/UNDP] 2010, 14). Total reductions based on annual rates of change may not be as easy to verify for the reader, but they are more moderate and realistic.

The trend change achieved by the MDGs between 2005 and 2013 (15.4% on average) is derived from the WHO, GBD and UNICEF mortality data referred to in note 10 above. It represents the difference between the total average reduction achieved by the MDGs from 2005 to 2013 (26.2%) and the reduction that would have occurred if the pre-2005 trends had continued to 2013 (10.8%). The difference is 15.4% of the 2005 level (or 15.4 percentage points).

This past change over 8 years can be extrapolated to a 15-year time frame in order to obtain figures for the SDG period from 2015 to 2030. The change of exponential trend is calculated as the difference in the results of two different mortality trends extrapolated by 2030; the trend before the MDGs showed effect (before 2005) and the trend since they showed effect (2005–2013):

Before-2005 MDG trend (−1.41% per year) extrapolated for 2015–30: $(1 + (-0.0141))^{15} - 1 = -19.2\%$

After-2005 MDG trend (−3.72% per year) extrapolated for 2015–30: $(1 + (-0.0372))^{15} - 1 = -43.4\%$

The difference is −24.2% of the starting level (or −24.2 percentage points), maintaining the average trend change achieved by the MDGs (review's calculations). Negative figures indicate a decrease (which represents an improvement).

For a 20-year time frame from 2010 to 2030, the resulting figure would instead be 28.4% of the 2010 level.

12 A trend-related target accommodates different country trends and conditions. With a global target in terms of trend change, countries improve on their increasing or decreasing trends by the same ambition for change, considering their different conditions and capabilities. Countries do not need to achieve the same absolute reduction, which requires more effort if the starting trend is stagnant or even increasing. For details and a diagram, see section 3 of our latest proposal (Global2015 2015, 7–9).

For a 2010 base year, the figure would be 28.4% of the 2010 level (percentage points) (see note 12 above).

If a trend-related target is not desired, an absolute reduction could be defined instead. This equals a figure of 55.5% for 2015–30, which is calculated as follows: According to the average extrapolated trends of deaths from lower respiratory infections (mainly pneumonia), a decrease by 31.3% from 2015 to 2030 is expected to be the result (see note 9 above). This decrease by 2030 marks the baseline for the trend improvement by 24.2% of the 2015 level (percentage points). If the 2015 level is taken as the base instead, then in order to define an absolute reduction the target would be −31.3% − 24.2% = −55.5% (percentage points). Accordingly, target 3.3 could be extended as follows: "By 2030, … halve the number of premature deaths from pneumonia, …" However, such an absolute reduction target does not address different country trends (see above).

The suggested wording assumes that for the SDG targets a general base year of 2015 will be set. For a 2010 base year, the figure for the absolute reduction would be −67.7% (including reductions achieved from 2010 to 2015).

13 GBD 2012, 2105.

14 WHO 2013a.

15 OWG 2014, 9 (goal 3, target 3.9). According to the currently decreasing trends, the target may not trigger change. See further

details in our 2014 proposal (Global2015 2014, 6). Diarrhoeal diseases are also related to OWG targets 6.1 and 6.2 to achieve access to safe drinking water and adequate sanitation for all by 2030 (success of these depend on the definition and measurement of safe water which had serious issues regarding the MDG target on safe water; WHO et al. 2011, 35; WHO et al. 2012, 5; Fewtrell et al. 2005, 44, 48; Bain et al. 2014, 918).

16 GBD 2015, 131 (1.26 million in 2013 [95% uncertainty range 1.15–1.38 million]); WHO 2014, sheet "Global2012" (1.50 million in 2012). Unlike the WHO Global Health Estimates, the GBD study does not include typhoid and paratyphoid fever in diarrhoeal diseases; which claimed an additional 161 000 and 54 300 deaths in 2013, respectively (95% uncertainty ranges 85 900–268 000 or 29 300–92 000, respectively) (GBD 2015, 131).

17 Fischer-Walker et al. 2013.

18 WHO 2013a.

19 GBD 2010 trend data: IHME [GBD] 2013, search term: "by age by year Global Diarrhea" (1990, 1995, 2000, 2005, 2010); GBD 2013 trend data: GBD 2014, Diarrheal Diseases (1990, 2013); WHO trend data: WHO 2014, sheets "Global2000" and "Global2012" (2000, 2012); age groups 0–69 years only.
In the diagram, the absolute figures have been indexed to 100% in 2015, according to the exponential extrapolation of their average trend (review's calculations). The trends of available WHO and GBD data were averaged and extrapolated as follows:
For each trend series an exponential regression was calculated (least square method), resulting in an annual rate of change of −2.64% for the GBD 2010 data (only the latest trend 2005–2010 was taken into account), −3.05% for the GBD 2013 data (1990–2013) and −3.05% for the WHO data (2000–2012). From these annual rates the exponential change over the 15-year period from 2015 to 2030 was derived, leading to a decrease of 33.1% for the GBD 2010 data, 37.2% for the GBD 2013 data and 37.1% for the WHO data. Example for the annual −3.05% rate: $(1 + (-3.05 / 100))^{15} - 1 = -0.372 = -37.2\%$. The 3 trend results for 2030 were averaged to a mean of 35.8% (of the 2015 level; percentage points), which represents an annual average rate of change of 2.91%; review's calculations, $((1 + -0.358) / 1)^{(1 / 15)} - 1 = 2.91\%$.
This is depicted in the diagram as the average extrapolated trend (from WHO and GBD data). It also serves as the base trend for applying the desired trend improvement of 24.2%, as achieved on average by the MDGs.

20 The MDG-related topics do not need to perform a trend change (again), instead they should continue with at least the average reductions achieved by the MDGs. That way the SDG targets can continue with the ambition of the MDGs. Underperforming MDG topics would need to speed up in order to meet the average MDG achievements and to complete unfinished business. More details can be found in note 11 above and in our latest proposal (Global2015 2015, section 2, 4–7).

21 With a global target in terms of trend change, countries improve on their increasing or decreasing trends by the same ambition for change, considering their different conditions and capabilities. Countries do not need to achieve the same absolute reduction, which requires more effort if the starting trend is stagnant or even increasing. For details and a diagram, see section 3 of our latest proposal (Global2015 2015, 7–9).
The suggested wording assumes that for the SDG targets a general base year of 2015 will be set. For a 2010 base year, the figure would be 53.2% of the 2010 level (including reductions achieved from 2010 to 2015; compare note 11 above).

22 If the average trend of deaths from diarrhoeal diseases continues, it would result in a decrease by 35.8% from 2015 to 2030 (see note 19 above). This increase by 2030 marks the baseline for the reaching the average MDG achievement of 43.4% of the 2015 level. In terms of trend improvement, the target is −43.4% − (−35.8%) = −7.6% (percentage points). Such a trend-related target addresses different country trends (see note 21 above).

23 GBD 2015, 133–135 (acute and chronic types were included, see categories in the diagram below). For comparison, see diagram on p. 1 above.
Viruses are the main cause of hepatitis (inflammation of the liver). The figure, as well as all following data, does not include other causes of hepatitis, such as toxines or alcohol use.

24 IHME [GBD] 2013, search term:
"by year Global Deaths Hep A Hep B "Hep C" Hep E Cirrhosis-HepB Cirrhosis-HepC Liver-HepB Liver-HepC".
For other major contagious diseases (as shown in the diagram on p. 1), see trend data in IHME [GBD] 2013 (on 1990, 1995, 2000, 2005 and 2010) and GBD 2015, 131 (table 2), "All ages deaths (thousands)", "Median % change" (between 1990 and 2013), in WHO 2014, sheets "Global2000" and "Global2012", and in our previous proposal (Global2015 2015, 3).

25 WHO 2014j (1.4 million cases of hepatitis A every year); WHO 2014k (over 3 million acute cases of hepatitis E every year); sum: review's calculation.

26 Chronic infections:
- Approximately 240 million people are chronically infected by hepatitis B (WHO 2014k; no reference year mentioned)
- 130–170 million people carried a chronic hepatitis C infection in 2008 (Lavanchy [WHO] 2009, 75);

Sums: review's calculations.
Approximately 185 million people had hepatitis C antibodies in 2005, but this includes people who no longer have an acute hepatitis C disease (and have also not developed chronic hepatitis C) (Mohd Hanafiah 2013).

27 Review's calculation from above-mentioned data, using WB 2014, world, 'Population (Total)', 2008 and 2011, respectively (assuming the year before publication as the referring year for the 240 million figure).

28 From 122 million people in 1990 with hepatitis C antibodies to 185 million in 2005 (Mohd Hanafiah 2013; the prevalence rate increased from 2.3% [95% uncertainty level 2.1–2.5%] to 2.8% [2.6–3.1%], respectively); percentage increase : review's calculation, (1 − (185 / 122)) = 0.516 = 51.6%.

29 WHO 2005b, 82 (resolution by WHO member states), 137 (annex), not mentioning hepatitis explicitly, but referring to vaccine-preventable diseases (the hepatitis B vaccine is available since 1982; WHO 2015).

30 Compared to 1990, the number of deaths caused by acute hepatitis B decreased from 85 000 to 68 600 in 2013 (GBD 2015, 133); percentage: review's calculation.

31 GBD 2015, 133–135 (table 2) (on 1990 and 2013); IHME [GBD] 2013, search term: "by year Global Deaths Hep A Hep B "Hep C" Hep E Cirrhosis-HepB Cirrhosis-HepC Liver-HepB Liver-HepC" (on 1990, 1995, 2000, 2005, 2010). For the 1990–2013 trend, such data points are scheduled to be released four months after the main release (i.e. April or May 2015).
Hepatitis D occurs only as a co-infection with hepatitis B and has therefore no figure on its own.

32 IHME [GBD] 2013, search term: "by year Global Deaths Hep A Hep B "Hep C" Hep E Cirrhosis-HepB Cirrhosis-HepC Liver-HepB Liver-HepC" (from 1.10 million deaths in 1995 to 1.44 million in 2010, equalling a 31.3% increase over 15 years; review's calculation); GBD 2015, 133–135 (from 895 000 in 1990 to 1.45 million in 2013, representing an annual exponential growth by 2.13%, which equals to an increase by 37.3% over 15 years; review's calculations).

33 WHO 2010a, § 1.

34 WHO 2010, § 1; referring to hepatitis C.

35 WHO 2007, 2 (referring to the identification of new diseases since the 1970s).

36 WHO 2007, 22 and 23 (globally); HMG [UK] 2014, 31–32, Annex A 67 (figures on different resistant pathogens in the UK).

37 Laxminarayan et al. 2013, 1057.

38 Van Boeckel et al. 2014, 745.

39 From 273 000 new cases in 2000 (95% uncertainty interval 185 000–414 000) (Dye et al. 2002, 1198; Zignol et al. 2006, 479) to 480 000 (350 000–610 000) in 2013 (WHO 2014h, 70); percentage: review's calculation.

40 No comprehensive data:
- Approximately 630 000 people worldwide suffered from multidrug-resistant tuberculosis (MDR-TB) in 2011 (WHO 2012, 20 [range 460 000–790 000]; in 2013, there were 480 000 new cases of multi-drug resistant tuberculosis [350 000–610 000] [WHO 2014h, 70]).
- Around 386 000 people in the EU, Iceland and Norway were infected with other antibiotic-resistant bacteria in 2007, including MRSA (methicillin-resistant staphylococcus aureus), third-generation cephalosporin-resistant e.coli (Escherichia coli) and penicillin-resistant streptococcus pneumoniae (a bacterium which can cause [pneumococcal] pneumonia, meningitis and other infectious diseases) (ECDC et al. 2009, 14).

Sum and percentage: review's calculations (using unrounded numbers and WB 2013, world, 'Population (Total)', World, 2007 and 2011).

41 Referring the 210 000 deaths from multidrug-resistant tuberculosis in 2013 to the 480 000 new cases in the same year (WHO 2014h, 70); ratio: review's calculation. The outcomes are better for MDR-TB patients with treatment: success at 48%, deaths at 15%, failed 9% in 2009 (WHO 2012, 51 [figure 4.8] [figures taken from diagram]).

42 RAM [UK] 2014, 5: deaths per year due to antimicrobial resistance: "AMR now 700,000 (low estimate)".

43 No comprehensive data:
- approximately 210 000 people died in 2013 from multidrug-resistant tuberculosis (MDR-TB) (range: 130 000–290 000) (WHO 2014h, 75)
- annually from other infections resistant to multiple drugs:
  - between 23 000 and 100 000 people died in the USA (CDC 2013, 13; Lo Fo Wong [WHO] 2013)
  - 80 000 in China and
  - 30 000 in Thailand (Lo Fo Wong [WHO] 2013)
  - as well as 25 100 people in the EU, Iceland and Norway in 2007 (ECDC et al. 2009, 14 [table 2], 4).

Sums: review's calculations (no overlap).

44 See the sources listed in the second paragraph of note 4 above (on a severe pandemic).

45 Available estimates:
- 3.1% of global GDP (Brahmbhatt [WB] 2006, 10, and WB 2006)
- 3.1% (Burns et al. [WB] 2008, 4)
- 4.25% (CBO 2006, 1, 12)
- 4.8% (severe pandemic; McKibbin et al. 2006, according to Burns et al. [WB] 2008, 3)
- 12.6% (ultra pandemic; McKibbin et al. 2006, 1, 26).

Mean of the 5 estimates: review's calculation.

46 WHO 2007, xxi, 50 (referring to avian H5N1 influenza).

47 Spellberg et al. 2008, 155.

48 Morens et al. 2008, 2, 7; WHO 2007, 1.

49 Dye et al. 2002, 1198 and Zignol et al. 2006, 479 (273 000 new cases in 2000 [95% uncertainty interval 185 000–414 000]); WHO 2014l, 49, 43 and WHO 2014m (450 000 cases [300 000–600 000] in 2012); WHO 2014h (480 000 cases in 2013 [350 000–

610 000]); RAM [UK] 2014, 5–6 (700 000 deaths "now", 10 million in 2050, without further action; based on scenarios by RAND Europe and KPMG).

50 WHO 2005 (resolution of the World Health Assembly), 14 (Art. 2: Purpose and Scope) (for adoption, p. 7).

51 Chan [WHO] 2014; Gostin et al. 2014; Kimball et al. 2014; Lancet 2014 and 2014a; Philips et al. 2014; WHO 2014b.

52 With a global target in terms of trend change, countries improve on their increasing or decreasing trends by the same ambition for change, considering their different conditions and capabilities. Countries do not need to achieve the same absolute reduction, which requires more effort if the starting trend is stagnant or even increasing. For details and a diagram, see section 3 of our latest proposal (Global2015 2015, 7–9).
For a 2010 base year, the figure would be 28.4% of the 2010 level (percentage points) (see note 31 above).

53 See note 12 and information box on p. 3 above. If the average trend of deaths from occupational diseases and accidents continues, it would result in a slight increase by 0.697% from 2015 to 2030 (see note 31 above). This increase by 2030 marks the baseline for the trend improvement by 24.2% of the 2015 level (percentage points). If instead the 2015 level is taken as the baseline, in order to define an absolute reduction, then the target is 0.697% − 24.2% = −23.5%. However, such an absolute reduction target does not address different country trends (see note 52 above).
The suggested wording assumes that for the SDG targets a general base year of 2015 will be set. For a 2010 base year, the figure for the absolute reduction would be −27.5% (including reductions achieved from 2010 to 2015).

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