

Lessons of the Millennium Development Goals

A Discussion Paper
on the Precursors of
Higher Living Standards
and Better Health

March 2016

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PUBLIC HEALTH SUMMIT

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Acknowledgments

The author would like to thank Ross DeVol, chief research officer at the Milken Institute, and Perry Wong, managing director of research at the Milken Institute, for their encouragement and support for this discussion paper. A special thanks to Edward Silver, our senior editor and associate director, for his editorial guidance and valuable suggestions. Any errors and omissions are the author's own.

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Executive Summary

The Millennium Declaration at the United Nations General Assembly in 2000 resulted in eight concrete and ambitious Millennium Development Goals (MDGs). Fifteen years after the adoption of the Millennium Declaration, the MDGs are considered a success.

For example, the U.N.'s evaluation of the MDGs, published in 2015, indicates that global childhood mortality fell by more than half (from 90 to 43 deaths per 1,000 live births), the maternal mortality rate dropped 45 percent, and new cases of HIV/AIDS, malaria, and tuberculosis fell by roughly 40 percent between 1990 and 2015.¹ The tremendous gains in health and other development indicators in recent decades led to a wider recognition of the importance of sustainable progress.² In September 2015, the U.N. General Assembly adopted the 2030 Agenda for Sustainable Development with 17 goals and 169 targets, ranging from eliminating poverty to environmentally responsible consumption and production.³

Although the U.N. officially refers to the MDGs as the “most successful anti-poverty movement in history,” evidence to support the MDGs’ effectiveness is mixed. The big challenge in evaluating such a global initiative is the difficulty of constructing a credible counterfactual scenario. In other words, we cannot be certain what the world would look like today without the MDGs. It is possible that the poverty rate or childhood mortality in South Asia or sub-Saharan Africa would be much higher without the MDGs. But it is also possible that they would be at current levels even if the MDGs had never been promulgated. Much of the scholarly literature that addresses the MDGs’ effectiveness compares the relevant measures today to their base levels in 1990 and attributes any and all improvements to the U.N. initiative. A few studies, however, attempt to assess their effectiveness by either testing whether the trend of relevant indicators improved sharply after the MDGs’ adoption or by projecting the trend observed before 2000 into the future and comparing the actual to the projected trends in each country.

This discussion paper focuses on three health-related MDGs. Namely, we look at the trends for the maternal mortality rate and the under-5 mortality rate. We also investigate the pattern of HIV/AIDS prevalence.

1. “The Millennium Development Goals Report 2015,” United Nations.

2. Noeleen Heyzer, “Sustaining Social Development in the 21st Century,” *The Power of Ideas: A Collection of Insights to Transform the Future*, Milken Institute, September 2015.

3. “Sustainable Development Goals,” United Nations, <https://sustainabledevelopment.un.org/>.

We contribute to the literature in three distinct ways. First, we estimate a latent dynamic common factor for the three health measures by geographic region. They are latent because dynamic common factors are not directly observed; rather, they are inferred from observed health indicators for countries in a given region. The trend of the childhood mortality rate in Sierra Leone, for example, reflects the sum of changes in mortality rate due to global efforts and the portion due to circumstances specific to that country. The dynamic factor analysis allows us to estimate that unobserved portion of mortality trend due to global efforts and, subsequently, reduces the influence of country-specific random shocks in the assessment of the MDGs. Furthermore, this approach mitigates the risk of false positive conclusions, as each country's trend can be viewed as the result of a separate experiment.

Second, we search for an unknown and slow-adjusting breakpoint for the common factor by region and health indicator. The common approach is to assume that change would take place right at or after the adoption of the MDGs. But the history of the MDGs indicates that some of the ideas and action plans were in place as early as the mid-1990s. Third, we estimate the relative contribution of latent real per-capita gross domestic product (precursors to income) and per-capita development assistance for health (foreign aid) to the sub-Saharan and South Asian latent common dynamic trends for maternal mortality.

Our investigation indicates the following:

- The latent common dynamic factor for the childhood mortality rate shows a downward trend for all regions. Furthermore, these trends are remarkably similar.
- The latent common dynamic factor for the maternal mortality rate exhibits large variation across regions. We also find some evidence that the maternal mortality rate in each region may be driven by more than one latent common dynamic factor.
- We find no substantive evidence of either sharp- or slow-adjusting breakpoints in latent dynamic factors for the three health measures across all regions.
- On average, almost all of the variation in declining trends in all three health measures is attributable to the latent factor associated with real per-capita income.

Although the findings reported in this discussion paper are preliminary, we are confident that they provide useful lessons. Specifically, the results indicate that the Millennium Development Goals have been complementary to the existing forces behind the downward trend in mortality across the globe. The factors that drive real income growth such as trade, investment in physical and human capital, access to financial capital, and rule of law appear to exert a disproportionate influence on the health indicators. Going forward with the Sustainable Development Goals, these factors should have the attention of policymakers at least as much as foreign aid does as they tackle global health issues.

A Brief Review of the Literature

The literature on the Millennium Development Goals is extensive. However, we limit our discussion to studies that evaluate their effectiveness. For general background, readers are advised to review the U.N.'s "MDG Report 2015," which provides comprehensive coverage of the MDGs' history and simple before-and-after comparisons of indicators.

Surprisingly, only a handful of studies attempt to evaluate the effectiveness of the MDGs. Most of these compare trends for each indicator before and after 2000, the year the goals were introduced. For example, Fukuda-Parr and Greenstein (2011) propose a relatively simple method of comparing the progress of a particular indicator between two points in time before and after the MDGs.⁴ Their analysis shows no discernible improvement in MDG indicators, with the exception of poverty measures.

Kenny and Sumner (2011) estimate trends for each indicator before 2000 and estimate what the indicator values would be if the past trend continued into the future.⁵ Then, they compare the actual values to the counterfactual values. The findings suggest the MDGs, on average, resulted in positive but small improvements.

Klasen and Lange (2012) follow a framework similar to Kenny and Sumner's, but instead of a linear trend they use a sigmoid-shaped transition path.⁶ Their projections of the trends for each country in sub-Saharan Africa into the post-MDG period show no significant improvement.

4. Fukuda-Parr, S., Greenstein, J., and Stewart, D., "How should MDG success and failure be judged: Faster progress or achieving the targets?" 2013, *World Development*, 41, pp. 19-30.

5. Kenny, C., and Sumner, A., "More money or more development: What have the MDGs achieved?," 2011, Center for Global Development Working Paper, 278.

6. Klasen, S., and Lange, S., "Getting progress right: Measuring progress towards the MDGs against historical trends," 2012, Courant Research Centre: Poverty, Equity and Growth Discussion Papers, No. 87.

Friedman (2013) and French (2014) adopt a methodology that allows a linear trend to vary before and after the MDGs were introduced.⁷ Their findings show no change in the trend after 2000. However, French's analysis provides statistically significant evidence of the relationship between the improvement in MDG indicators and economic growth.

Similarly to the aforementioned studies, this discussion paper attempts to ascertain whether the MDGs accelerated the rate of progress for three health-related MDG indicators. But we approach the problem from a different angle. Instead of comparing before-and-after trends for each country, we estimate region-specific nonlinear common trends using the dynamic factor analysis method. Just as the average guess of a large group is more likely to be accurate than the guess of any individual in that group, a common nonlinear trend is more likely to provide an accurate depiction of how any of the three health indicators evolved over time. Additionally, our analytical framework accommodates change occurring either before or after adoption of the MDGs, and it allows for the possibility of a slow transition to a new trend, rather than assuming a sudden disruption in the pattern of a health indicator.⁸

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7. Friedman, H.S., "Causal Inference and the Millennium Development Goals (MDGs): Assessing Whether There Was an Acceleration in MDG Development Indicators Following the MDG Declaration," 2013, Munich Personal RePEc Archive Papers, No. 48793. French, D., "Did the Millennium Development Goals change trends in child mortality?" 2014, Queen's University Management School Work Paper Series, FIN 14-11.
 8. This portion of the analysis is based on Chiu, G., Lockhart, R., and Routledge, R., "Bent-Cable Regression Theory and Applications," 2006, *Journal of the American Statistical Association*, Vol 101, No. 474, pp. 542-553. We used "bentcableAR" package for R, version 0.3.0., for computational purposes.

Region-Specific Trends and Structural Changes⁹

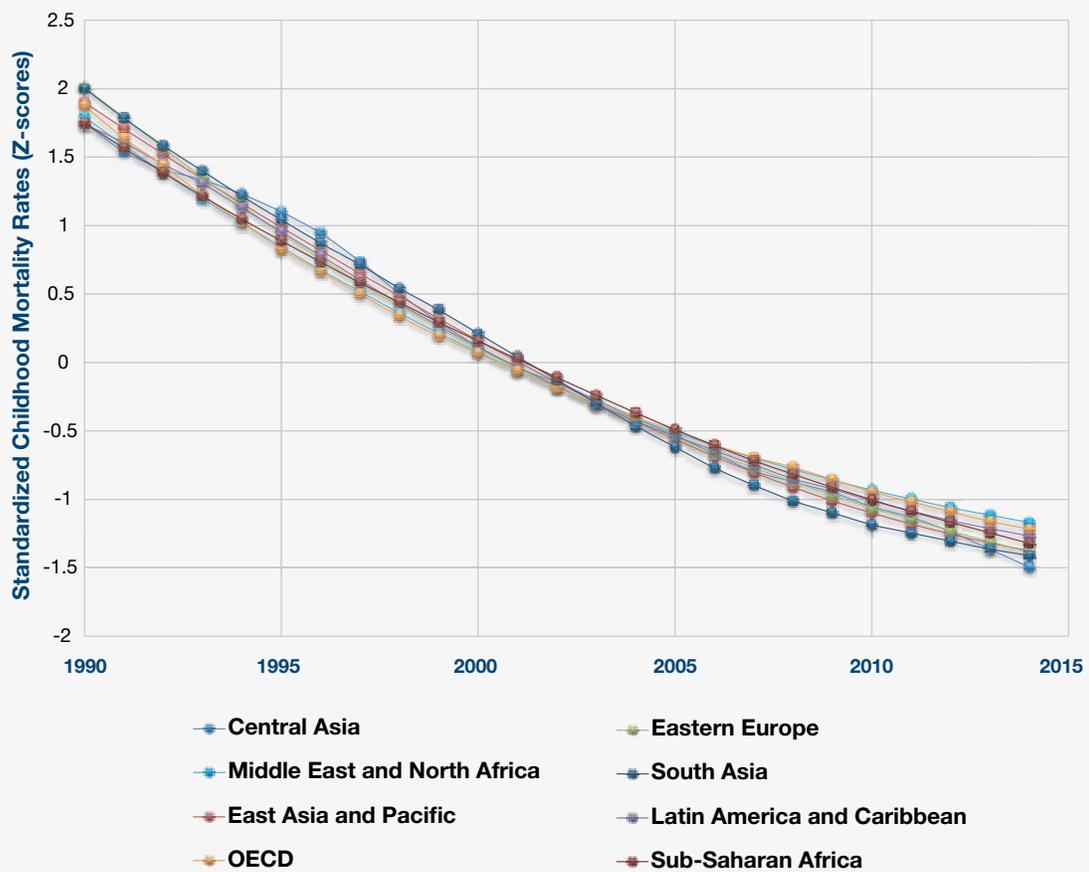
We constructed a dataset for 191 countries using the publicly available U.N. database, the World Bank's World Development Indicators database, and the World Health Organization database. Our approach to extracting region-specific trends is based on the dynamic factor analysis method. The general form of the estimable equations is as follows:

$$\begin{aligned}x_t &= x_{t-1} + w_t \\y_t &= Zx_t + a + u_t \\x_0 &\sim MVN(\mu, \Delta) \\w_t &\sim MVN(0, Q) \\u_t &\sim MVN(0, R)\end{aligned}$$

We follow Zuur et al.'s (2003) estimation procedure.¹⁰ The y_t series denote actual mortality rates or prevalence rates of HIV/AIDS in each country. The latent common dynamic factors, x_t , are structured to follow random walk. In other words, a latent common trend at time t equals its previous value in time $t-1$ plus the random shock, w_t . These latent common dynamic factors capture information shared by observed mortality rates or prevalence rates for each country in its respective region. The analysis relied on the MARSS package for R, which employs the EM algorithm to solve for latent common dynamic factors. The results of estimating latent common dynamic factors x_t are provided in Figures 1-3.

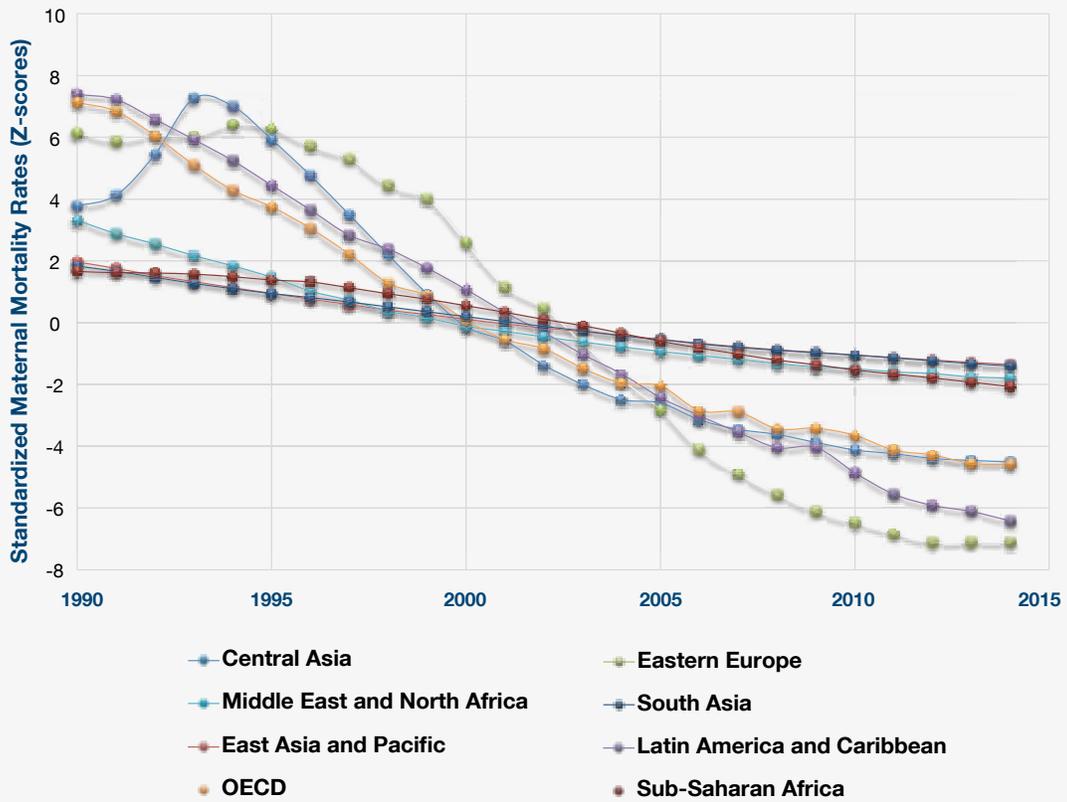
9. Detailed tables of estimated factor loadings, regional latent dynamic factors, and test results for structural breaks are available upon request from the author at ksagynbekov@milkeninstitute.org.

10. Zuur, A.F., Tuck, I.D., and Bailey, N., "Dynamic factor analysis to estimate common trends in fisheries time series," 2003, *Can.J.Fish.Aquat.Sci*, 60, pp. 542-552.

Figure 1 | Childhood Mortality Has Declined in All Regions Since 1990

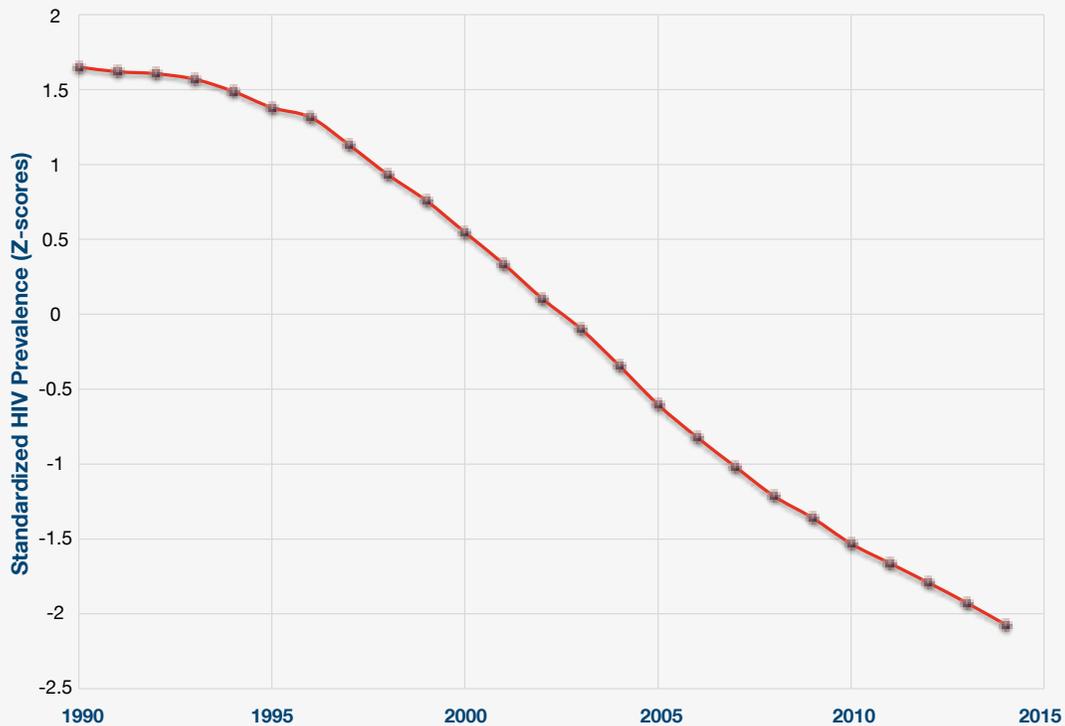
Source: Milken Institute.

Figure 2 | Maternal Mortality Has Declined in All Regions Since 1990



Source: Milken Institute.

Figure 3 | The Decline in HIV/AIDS Prevalence in Sub-Saharan Africa Accelerated Before 2000



Source: Milken Institute.

Our findings indicate:

- The latent common dynamic factor for the childhood mortality rate shows a downward trend in all regions. Furthermore, these trends are remarkably similar.
- The latent common dynamic factor for the maternal mortality rate exhibits substantial variation across regions. We also find some evidence that the maternal mortality rate in each region may be driven by more than one latent common dynamic factor.
- No substantive evidence of either sharp- or slow-adjusting breakpoints in latent common dynamic factors for the three health measures across all regions.

The Relative Importance of Development Assistance

We carried out a series of estimations of how the latent common dynamic factors for the maternal mortality rate in sub-Saharan Africa and South Asia are influenced by precursors of real per-capita income and per-capita development assistance for health (foreign aid).

Following the estimation, we assessed what proportion of the total decline in the maternal mortality rate in each region is attributable to income and foreign aid. The results are shown in Table 1.¹¹

Table 1 | Latent Common Dynamic Factors for Maternal Mortality Rate, Sub-Saharan Africa and South Asia

Explanatory Variables	Beta Squared	Lindeman-Merenda-Gold	R-Squared Decomposition
SUB-SAHARAN AFRICA			
Foreign Aid	1%	27%	19%
Income	99%	73%	81%
SOUTH ASIA			
Foreign Aid	1%	18%	11%
Income	99%	82%	89%

Note: Beta squared, Lindeman-Merenda-Gold, and R-squared decomposition are criteria to allocate the proportion of variation to each explanatory variable.

The results of the relative importance analysis indicate that on average, almost all of the variation in declining trends in the three health measures is attributable to the latent factor associated with real per-capita income.

11. Our approach is informed by Toninandel, S., and LeBreton, J.M., "Relative Importance Analysis: A Useful Supplement to Regression Analysis," 2011, *J.Bus.Psychol.*, 26, pp. 1-9. The computational part relied on Grömping, U., "Relative Importance for Linear Regression in R: The Package relaimpo," 2006, *Journal of Statistical Software*, 17, Issue 1.

Conclusion

Although the findings reported in this discussion paper are preliminary, we are confident that they provide useful lessons. Specifically, the results indicate that the Millennium Development Goals have been complementary to the existing forces behind the downward trend in mortality across the globe.

The factors that drive real income growth, such as trade, investment in physical and human capital, access to financial capital, and rule of law, appear to exert a disproportionate influence on the health indicators. Going forward with the Sustainable Development Goals, these factors should have the attention of policymakers at least as much as foreign aid does as they tackle global health issues.

In addition to the aforementioned findings, this discussion paper highlights the complex nature of how global health indicators evolved over recent decades. Therefore, it is unlikely that a single policy lever can be identified as the main driver of global health improvements. In that respect, our findings are not novel. However, our application of the latent common dynamic factor analysis combined with the relative importance analysis provides a novel and statistically robust way to identify a subset of factors that played a greater role in improving health indicators.

About the Author

DR. KEN SAGYNBEKOV is a health economist at the Milken Institute. His research focuses primarily on applied microeconomic analysis of health and crime, with an emphasis on quantitative methods. Sagynbekov's work has been published in peer-reviewed academic journals and government reports. Before joining the Institute, he was a tenured assistant professor of economics at the University of Regina in Canada, where he taught econometrics and the economics of health and served as lead investigator in several large government-funded research projects. In addition to academia, Sagynbekov worked as an economic consultant in Central Asia with USAID's fiscal reform initiative. He received a B.Sc. in finance from Clemson University and earned his M.A. and Ph.D. degrees in economics from the University of Mississippi. He works at the Institute's Santa Monica office.



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