

# Curriculum vitae – Leontine Alkema

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## CONTACT INFORMATION

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Pronouns	she/her/hers

## RESEARCH INTERESTS

Methodological:	Bayesian inference; Statistical demography; Causal inference.
Substantive:	Family planning; Abortion and unintended pregnancies; Fertility; Reproductive health; Global health

## EDUCATION

2008	University of Washington, Seattle, USA Ph.D. Studies in Statistics, with Ph.D. track in Statistical Demography (2006) Dissertation: <i>Uncertainty assessments of demographic estimates and projections</i> Advisors: Prof. A. E. Raftery and Dr. S. J. Clark
2003	Delft University of Technology, the Netherlands M.S., Applied Mathematics Thesis: <i>Multivariate time series analysis of oil reservoir pressure</i>
2002	Delft University of Technology, the Netherlands B.S., Applied Mathematics

## EMPLOYMENT AND OTHER RESEARCH POSITIONS

2022 –	Professor, Department of Biostatistics and Epidemiology University of Massachusetts, Amherst.
2018 – 2022	Associate Professor, Department of Biostatistics and Epidemiology University of Massachusetts, Amherst.
2015 – 2018	Assistant Professor, Department of Biostatistics and Epidemiology University of Massachusetts, Amherst.
2014	Visiting Assistant Professor, Department of Demography, UC Berkeley (Spring).
2012 – 2015	Honorary Assistant Professor, Saw Swee Hock School of Public Health National University of Singapore, Singapore.
2009 – 2015	Assistant Professor, Department of Statistics and Applied Probability, National University of Singapore, Singapore.

- 2013 – 2019 Lead technical advisor and consultant for maternal mortality estimation for the Maternal Mortality Estimation Inter-Agency Group (UN MMEIG, agencies involved: WHO, UNICEF, UNFPA, the World Bank and the UN Population Division).
- 2010 – 11 Consultant, United Nations Population Division, New York. Project: Method development to construct estimates and projections of family planning indicators.
- 2009 Lecturer, Department of Statistics, Columbia University, New York (Spring).
- 2008 – 09 Postdoctoral Research Fellow, Earth Institute, Columbia University, New York.
- 2006 – 08 Shanahan Fellow, Center for Studies in Ecology and Demography, University of Washington.
- 2005 – 08 Research assistant, Department of Statistics, University of Washington, Seattle.
- 2007 Visiting researcher, Centre for Actuarial Research, University of Cape Town, Cape Town, South Africa (2 months).
- 2007 Research intern, African Population and Health Research Center, Nairobi, Kenya. Topic: Poverty measurement in slum settlements (6 months).
- 2006 Consultant, Joint United Nations programme on HIV/AIDS (UNAIDS). Project: Development of a Bayesian melding approach for assessing uncertainty in the UNAIDS Estimation and Projection Package tool for estimating HIV prevalence in generalized epidemics.
- 2006 Research intern, United Nations Population Division, New York. Topic: Assessing uncertainty in fertility projections (3 months).
- 2003 Research assistant, Shell, the Netherlands.
- 2002 Research intern, WWF Denpasar, Indonesia. Topic: Analysis of fisheries data (3 months).

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#### FELLOWSHIPS AND AWARDS

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- 2020 – 2021 Faculty Success Fellow, University of Massachusetts Amherst.
- 2020 Public Engagement Project Fellowship, University of Massachusetts Amherst.
- 2013 Young Scientist Award; Faculty of Science, National University of Singapore.
- 2011 – 12 Excellent Young Teacher Award; Faculty of Science, National University of Singapore.
- 2009 – 10 Excellent Young Teacher Award; Faculty of Science, National University of Singapore.
- 2008 – 09 Earth Institute Postdoctoral Fellowship; Columbia University.
- 2006 – 08 Shanahan Fellowship, Center for Studies in Ecology and Demography; University of Washington.
- 2004 Hubert M. Blalock Fellowship, Center for Statistics and the Social Sciences; University of Washington.
- 2004 Post-graduate Study Award; VSB Bank, the Netherlands.
- 1997 Delft University of Technology Star Award; Delft University of Technology, the Netherlands.

GRANTS

Active

Years	Organization, Title	Amount - role
2023 -	Funding from the Bill & Melinda Gates Foundation through Avenir Health; USA <i>Bayesian model development for the Family Planning Estimation tool and FP Goals</i>	Subcontract PI

Completed

Years	Organization, Title	Amount
2017-22	The Bill & Melinda Gates Foundation; USA <i>Improved monitoring of family planning indicators: statistical approaches and tools to improve strategic information at national and subnational levels.</i>	\$1,406,258 - PI
2017 – 22	National Institutes of Health; USA <i>Improving the measurement of adolescent and adult mortality in low-income countries.</i>	\$347,021 Subcontract PI
2018 – 20	UNICEF <i>Development of improved methods for estimating stillbirth rates.</i>	\$32,000 - PI
2018 – 19	World Health Organization <i>Development of improved methods for estimating maternal mortality.</i>	\$67,499 - PI
2015 – 18	Funding from the Bill & Melinda Gates Foundation through Avenir Health; USA <i>Further development of the estimation and forecasting model for contraceptive prevalence and related family planning indicators for FP2020.</i>	\$400,000 Subcontract PI
2014 – 15	Ministry of Education Singapore <i>Development of new estimation and projection methods for key global demographic and health indicators.</i>	S\$84,000 - PI
2013 – 15	Humanities and Social Sciences Research Fund; National University of Singapore <i>Missing Girls: An Analysis of Trends in Pre- and Postnatal Gender Discrimination.</i>	S\$249,100 - PI
2013 – 15	Global Asia Institute Research Grant; National University of Singapore <i>Human capital in Asia: modeling and analyzing sub-regional levels and trends.</i>	S\$138,800 - PI
2013	UNICEF <i>Development of an improved estimation method for under-5 mortality.</i>	~\$20,000 - PI
2013	UNICEF <i>Estimating sex differentials in child mortality (preliminary study).</i>	~\$20,000 - PI
2010 – 13	Global Asia Institute, National University of Singapore <i>Estimating and Projecting Urbanization and City Growth.</i>	S\$231,500 – Co-PI

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## PEER-REVIEWED PUBLICATIONS

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Notes for co-author role at the time of majority of effort: \* = postdoc, graduate student, research associate, or undergraduate student.

56. CH. Lee, H. Susmann\*, **L. Alkema** (2023). New measures for family planning and exposure to risk of pregnancy based on sexual activity and contraceptive use data. *Studies in Family Planning*. <https://doi.org/10.1111/sifp.12225>
55. J.M. Bearak, **L. Alkema**, V. Kantorova, J. Casterline (2023). Alignment between desires and outcomes among women wanting to avoid pregnancy: a global comparative study of 'conditional' unintended pregnancy rates. *Studies in Family Planning*.
54. Z. Wang\*, M. Fix, L. Hug, A. Mishra, D. You, H. Blencowe, J. Wakefield, **L. Alkema** (2022). Estimating the stillbirth rate for 195 countries using a Bayesian sparse regression model with temporal smoothing. *Annals of Applied Statistics* 16(4): 2101-2121. DOI: 10.1214/21-AOAS1571
53. M. Alexander, **L. Alkema** (2022). A Bayesian cohort component projection model to estimate women of reproductive age at the subnational level in data-sparse settings. *Demography* 59 (5): 1713–1737. <https://doi.org/10.1215/00703370-10216406>
52. A. Dharamshi, B. Barakat, **L. Alkema**, M. Antoninis (2022). A Bayesian model for estimating Sustainable Development Goal indicator 4.1.2: School completion rates. *Journal of the Royal Statistical Society: Series C*. Online first.
51. J. Bearak, A. Popinchalk, B. Ganatra, A. Moller, Ö. Tunçalp, C. Beavin, L. Kwok, **L. Alkema** (2022). Country-specific estimates of unintended pregnancy and abortion incidence: a global comparative analysis of levels in 2015–2019. *BMJ Global Health* 7:e007151. See <https://gh.bmj.com/content/7/3/e007151>.
50. H. Susmann\*, M. Alexander, **L. Alkema** (2022). Temporal models for demographic and global health outcomes in multiple populations: Introducing a new framework to review and standardize documentation of model assumptions and facilitate model comparison. *International Statistical Review*. Early view <https://onlinelibrary.wiley.com/doi/full/10.1111/insr.12491>.
49. E. Peterson\*, D. Chou, A.B. Moller, A. Gemmill, L. Say, **L. Alkema** (2022). Estimating misclassification errors in the reporting of maternal mortality in national civil registration vital statistics systems: A Bayesian hierarchical bivariate random walk model to estimate sensitivity and specificity for multiple countries and years with missing data. *Statistics in Medicine* 41:2483–2496. <https://onlinelibrary.wiley.com/doi/full/10.1002/sim.9335>.
48. D. Sharrow, L. Hug, D. You, **L. Alkema**, R. Black, S. Cousens, T. Croft, V. Gaigbe-Togbe, P. Gerland, M. Guillot, K. Hill, B. Masquelier, C. Mathers, J. Pedersen, K. Strong, E. Suzuki, J. Wakefield, N. Walker (2022). Global, regional and national trends in under-5 mortality 1990-2019 with scenario-based projections to 2030: a systematic analysis by the United Nations Inter-agency Group for Child Mortality Estimation. *The Lancet Global Health* 10(2): e195–206. [https://doi.org/10.1016/S2214-109X\(21\)00515-5](https://doi.org/10.1016/S2214-109X(21)00515-5).

47. F. Chao\*, A.R. Cook, P. Gerland, **L. Alkema** (2021). Global estimation and scenario-based projections of sex ratio at birth and missing female births using a Bayesian hierarchical time series mixture model. *Annals of Applied Statistics* 15(3): 1499-1528.
46. N. Cahill, E. Sonneveldt, P. Emmart, J. Williamson, R. Mbu, A. Barrière Fodjo Yetgang, I. Dambula, G. Azambuja, A. Mahumane Govo, B. Joshi, S. Felix, C. Makashaka, V. Ndaruhutse, J. Serucaca, B. Madzima, B. Muzavazi, **L. Alkema** (2021). Using family planning service statistics to inform model-based estimates of modern contraceptive prevalence. *Plos One* 16(10), e0258304.
45. L. Hug, D. You, H. Blencowe, A. Mishra, Z. Wang\*, M. Fix, J. Wakefield, A. Moran, V. Gaigbe-Togbe, E. Suzuki, D. Blau, S. Cousens, A. Creanga, T. Croft, K. Hill, K Joseph, S. Maswime, E. McClure, R. Pattinson, J. Pedersen, L. Smith, J. Zeitlin, **L. Alkema** (2021). Global, regional, and national levels and trends in stillbirths from 2000 to 2019: a systematic assessment. *The Lancet* 398 (10302): 772–85.
44. F. Chao\*, A.R. Cook, P. Gerland, C. Guilmoto, **L. Alkema** (2021). Projecting sex imbalances at birth at global, regional and national levels from 2021 to 2100: scenario-based Bayesian probabilistic projections of the sex ratio at birth and missing female births based on 3.26 billion birth records. *BMJ Global Health* (6): e005516.
43. G. Guranich\*, N. Cahill, **L. Alkema** (2021). Fpemlocal: Estimating family planning indicators in R for a single population of interest. *Gates Open Research* 5 (24).
42. B. Masquelier, L. Hug, D. Sharrow, D. You, C. Mathers, P. Gerland, **L. Alkema** (2021). Global, regional, and national mortality trends in youth aged 15–24 years between 1990 and 2019: a systematic analysis. *The Lancet Global Health* 9 (4): e409–17.
41. N. Cahill, M. Weinberger, **L. Alkema** (2020). What increase in modern contraceptive use is needed in FP2020 countries to reach 75% demand satisfied by 2030? An assessment using the Accelerated Transition Method and Family Planning Estimation Model. *Gates Open Research* 4 (113).
40. J. Bearak, A. Popinchalk, B. Ganatra, A. Moller, Ö. Tunçalp, C. Beavin, L. Kwok, **L. Alkema** (2020). Unintended Pregnancy and Abortion by Income, Region, and the Legal Status of Abortion: Estimates from a Comprehensive Model for 1990–2019. *The Lancet Global Health* 8(9): e1152–61.
39. F. Chao\*, A.R. Cook, P. Gerland, **L. Alkema** (2019). A systematic assessment of the sex ratio at birth for all countries and estimation of national imbalances and regional reference levels. *Proceedings of the National Academy of Sciences* 116(19), 9303-9311.
38. J. Bearak, A. Popinchalk, G. Sedgh, B. Ganatra, A. Moller, Ö. Tunçalp, **L. Alkema** (2019). Pregnancies, abortions, and pregnancy intentions: a protocol for modeling and reporting global, regional and country estimates. *Reproductive Health* 16(1) 36.
37. L. Hug, M. Alexander\*, D. You, **L. Alkema** (2019). National, regional, and global levels and trends in neonatal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the United Nations Inter-agency Group for Child Mortality Estimation. *The Lancet Global Health* 7(9), e710-e720.

36. B. Masquelier, L. Hug, D. Sharrow, D. You, D. Hogan, K. Hill, J. Liu, J. Pedersen, **L. Alkema** (2018). Global, regional, and national levels and trends in mortality among older children (5-9) and young adolescents (10-14) from 1990 to 2016. *The Lancet Global Health* 6(10): e1087-e1099.
35. F. Chao\*, D. You, J. Pedersen, L. Hug, **L. Alkema** (2018). National and regional under-5 mortality rate by economic status for low-income and middle-income countries: a systematic assessment. *The Lancet Global Health* 6(5): e535-e547.
34. J. Bearak, A Popinchalk, **L. Alkema**, G. Sedgh (2018). Global, regional, and subregional trends in unintended pregnancy and its outcomes from 1990 to 2014: estimates from a Bayesian hierarchical model. *The Lancet Global Health* 6(4): e380 - e389.
33. M. Alexander\*, **L. Alkema** (2018). Global estimation of neonatal mortality using a Bayesian hierarchical splines regression model. *Demographic Research* 38: 335 – 372.
32. N. Cahill\*, E. Sonneveldt, J. Stover, M. Weinberger, J. Williamson, C. Wei\*, W. Brown, **L. Alkema** (2018). Modern contraceptive use, unmet need, and demand satisfied among women of reproductive age who are married or in a union in the focus countries of the Family Planning 2020 initiative: a systematic analysis using the Family Planning Estimation Tool. *The Lancet* 391(10123): 870 – 882.
31. B. Ganatra, C. Gerdt, C. Rossier, R. Johnson, Ö. Tunçalp, A. Assifi, G. Sedgh, S. Singh, A. Bankole, A. Popinchalk, J. Bearak, Z. Kang\*, **L. Alkema** (2017). Global, regional and sub-regional classification of abortions by safety: Estimates for 2010-14. *The Lancet* 390(10110): 2372-2381.
30. **L. Alkema**, S. Zhang\*, D. Chou, A. Gemmill\*, A.B. Moller, D.M. Fat, L. Say, C.D. Mathers, D. Hogan. A Bayesian approach to the global estimation of maternal mortality (2017). *The Annals of Applied Statistics* 11(3): 1245 – 1274.
29. V. Kantorova, J.R. New\*, A. Biddlecom, **L. Alkema** (2017). Setting ambitious yet achievable targets using probabilistic projections: meeting demand for family planning. *Studies in Family Planning* 48(3): 223 – 233.
28. J.R. New\*, N. Cahill\*, J. Stover, Y.P. Gupta, **L. Alkema** (2017). Subnational Rates and Trends in Contraceptive Prevalence and Unmet Need for Family Planning from 1990 to 2020: An Analysis for All 29 States in India. *The Lancet Global Health* 5(3): e350-e358.
27. G. Sedgh, J. Bearak, S. Singh, A. Bankole, A. Popinchalk, B. Ganatra, C. Rossier, C. Gerdt, Ö. Tunçalp, R. Johnson, H.B. Johnston, **L. Alkema** (2016). Abortion incidence between 1990 and 2014: global, regional, and subregional levels and trends. *The Lancet* 388(10041): 258 – 267.
26. **L. Alkema**, D. Chou, D. Hogan, S. Zhang\*, A.B. Moller, A. Gemmill\*, D.M. Fat, T. Boerma, M. Temmerman, C.D. Mathers, L. Say (2016). Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Inter-agency Group for Maternal Mortality Estimation. *The Lancet* 387(10017): 462 – 474.
25. D. You, L. Hug, S. Ejdemyr, P. Idele, D. Hogan, C. Mathers, P. Gerland, J.R. New\*, **L. Alkema** (2015). Global, regional, and national levels and trends in under-5 mortality between 1990 and 2015, with

scenario-based projections to 2030: a systematic analysis by the UN Inter-agency Group for Child Mortality Estimation. *The Lancet* 386(10010): 2275–2286.

24. **L. Alkema**, P. Gerland, A.E. Raftery, J. Wilmoth (2015). The United Nations Probabilistic Population Projections: An Introduction to Demographic Forecasting with Uncertainty. *Foresight: The International Journal of Applied Forecasting* 37: 19–24.
23. **L. Alkema**, J.R. New\* (2014). Global estimation of child mortality using a Bayesian B-spline bias-reduction method. *The Annals of Applied Statistics* 8(4): 2122–2149.
22. P. Gerland, A.E. Raftery, H. Ševčíková, N. Li, D. Gu, T. Spoorenberg, **L. Alkema**, B.K. Fosdick, J. Chunn, N. Lalic, G. Bay, T. Buettner, G.K. Heilig, J. Wilmoth (2014). World population stabilization unlikely this century. *Science* 346(6206): 234–237.
21. **L. Alkema**, F. Chao\*, D. You, J. Pedersen, C.C. Sawyer (2014). National, regional, and global sex ratios of infant, child, and under-5 mortality and identification of countries with outlying ratios: a systematic assessment. *The Lancet Global Health* 2(9): e521–e530.
20. **L. Alkema**, J.R. New\*, J. Pedersen, D. You, on behalf of the members of the UN Inter-agency Group for Child Mortality Estimation and its Technical Advisory Group (2014). Child Mortality Estimation 2013: An overview of updates in estimation methods by the United Nations Inter-agency Group for Child Mortality Estimation. *PLOS ONE* 9(7): e101112.
19. L. Say, D. Chou, A. Gemmill\*, Ö. Tunçalp, A.B. Moller, J. Daniels, A.M. Gülmezoglu, M. Temmerman, **L. Alkema** (2014). Global causes of maternal deaths: A WHO systematic analysis. *The Lancet Global Health* 2(6): e323–e3332.
18. T.P. Phan, **L. Alkema**, E.S. Tai, K.H.X. Tan, Q. Yang, W.Y. Lim, Y.Y. Teo, C.Y. Cheng, X. Wang, T.Y. Wong, K.S. Chia, A.R. Cook (2014). Forecasting the burden of type 2 diabetes in Singapore using a demographic epidemiological model of Singapore. *BMJ Open Diabetes Research and Care* 2(1): e000012.
17. A.E. Raftery, **L. Alkema**, P. Gerland (2014). Bayesian population projections for the United Nations. *Statistical Science*, 29(1): 56–68.
16. F. Chao\*, **L. Alkema** (2014). How informative are vital registration data for estimating maternal mortality? A Bayesian analysis of WHO adjustment data and parameters. *Statistics and Public Policy*, 1(1): 6–14.
15. **L. Alkema**, G. Jones, C. Rue\* (2013). Levels of urbanization in the world's countries: testing consistency of estimates based on national definitions. *Journal of Population Research*, 30(4): 291–304.
14. M. Oestergaard, **L. Alkema**, J.E. Lawn (Editorial, 2013). Millennium Development Goals national targets are moving targets and the results will not be known until well after the 5 deadline of 2015. *International Journal of Epidemiology* 42(3): 645–647.

13. **L. Alkema**, V. Kantorova, C. Menozzi, A. Biddlecom (2013). National, regional and global rates and trends in contraceptive prevalence and unmet need for family planning between 1990 and 2015: a systematic and comprehensive analysis. *The Lancet* 381(9878): 1642–1652.
12. **L. Alkema**, J.R. New\* (2012). Progress toward global reduction in under-5 mortality: A bootstrap analysis of uncertainty in Millennium Development Goal 4 estimates. *PLOS Medicine* 9(12): e1001355.
11. **L. Alkema**, D. You (2012). Child Mortality Estimation: a comparison of UN-IGME and IHME estimates of levels and trends in under-5 mortality rates and deaths. *PLOS Medicine* 9(8): e1001288.
10. **L. Alkema**, M. Wong\*, P.R. Seah\* (2012). Monitoring progress towards Millennium Development Goal 4: A call for improved validation of under-5 mortality rate estimates. *Statistics, Politics, and Policy* 3(2): Art. 2.
9. **L. Alkema**, A. E. Raftery, P. Gerland, S. J. Clark, F. Pelletier (2012). Estimating trends in the total fertility rate with uncertainty using imperfect data: Examples from West Africa. *Demographic Research* 26(15): 331–362.
8. **L. Alkema**, W.L. Ann\* (2011). Estimating the under-5 mortality rate using a Bayesian hierarchical time series model. *PLOS ONE* 6(9): e23954.
7. **L. Alkema**, A. E. Raftery, P. Gerland, S.J. Clark, F. Pelletier, T. Buettner, G. K. Heilig (2011). Probabilistic projections of the total fertility rate for all countries. *Demography* 48(3): 815–839.
6. H. Ševčíková, **L. Alkema**, A.E. Raftery (2011). BayesTFR: An R package for probabilistic projections of the total fertility rate. *Journal of Statistical Software* 43: 1–29.
5. L. Winowiecki, S. Smukler, K. Shirley, R. Remans, G. Peltier, E. Lothes, E. King, L. Comita, S. Baptista, **L. Alkema** (2011). Tools for enhancing interdisciplinary communication. *Sustainability: Science, Practice & Policy* 7(1): 74–80.
4. L.F. Johnson, **L. Alkema**, R.E. Dorrington (2010). A Bayesian approach to uncertainty analysis of sexually transmitted infection models. *Sexually Transmitted Infections* 86: 169–174.
3. **L. Alkema**, A.E. Raftery, T. Brown (2008). Bayesian melding for estimating uncertainty in national HIV prevalence estimates. *Sexually Transmitted Infections* 84 (Suppl I): i11–i16.
2. T. Brown, J.A. Salomon, **L. Alkema**, A.E. Raftery, E. Gouws (2008). Progress and challenges in modelling country-level HIV/AIDS epidemics: the UNAIDS Estimation and Projection Package 2007. *Sexually Transmitted Infections* 84 (Suppl I): i5–i11.
1. **L. Alkema**, A.E. Raftery, S.J. Clark (2007). Probabilistic projections of HIV prevalence using Bayesian melding. *The Annals of Applied Statistics* 1(1): 229–248.



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OTHER PAPERS: WORKING, DISCUSSION, AND WHITE PAPERS

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H. Susmann\* and **L. Alkema** (2023). Flexible Modeling of Demographic Transition Processes with a Bayesian Hierarchical Penalized B-Splines Model. See <https://doi.org/10.48550/arXiv.2301.09694>.

CH. Lee, H. Susmann\*, **L. Alkema** (2023). A Bayesian analysis of current duration data with reporting issues: an application to estimating the distribution of time-between-sex from time-since-last-sex data as collected in cross-sectional surveys in low- and middle-income countries. See <https://arxiv.org/abs/2302.00951>

E. N. Peterson\*, G. Guranich\*, J.A. Cresswell, **L. Alkema** (2022, under review). A Bayesian approach to estimate maternal mortality globally using national civil registration vital statistics data accounting for reporting errors.

**L. Alkema**, G. Yang\* and K. Gile (2022). Model-based estimates in demography and global health: quantifying the contribution of population-period-specific information.

**L. Alkema** (2020, R&R). The Global Burden of Disease fertility forecasts: Summary of the approach used and associated statistical concerns. See <https://osf.io/3m6va>.

C. Wei\* and **L. Alkema** (2021). How to estimate a population proportion if data are possibly subject to misclassification error? The case of estimating contraceptive prevalence based on self-reported usage. <https://submissions2.miramsmart.com/PAA2021/ViewSubmissionFile.aspx?sbmID=2021&mode=html&validate=false>

J. Bearak, A. Popinchalk, B. Ganatra, A. Moller, Ö. Tunçalp, C. Beavin, L. Kwok, **L. Alkema** (2020). Global estimation of unintended pregnancy and abortion using a Bayesian hierarchical random walk model. See <https://arxiv.org/abs/2007.09246>.

V. Adjiwanou, N. Alam, **L. Alkema**, et al. (2020). Measuring excess mortality during the COVID-19 pandemic in low- and lower-middle income countries: the need for mobile phone surveys. See <https://osf.io/preprints/socarxiv/4bu3q/>

V. Adjiwanou, **L. Alkema**, J. Long, T. McCormick (2018). Big data, big models, uncertainty, and bias: Data collection and modeling in low resource settings. White paper prepared for the NIH BD2K Behavioral and Social Sciences and Big Data Workshop.

G.A. Stevens, **L. Alkema**, R.E. Black, J.T. Boerma, G.S. Collins, M. Ezzati, J.T. Grove, D.R. Hogan, M.C. Hogan, R. Horton, J.E. Lawn, A. Marušić, C.D. Mathers, C.J.L. Murray, I. Rudan, J.A. Salomon, P.J. Simpson, T. Vos, V. Welch, GATHER Working Group (2016). Guidelines for accurate and transparent health estimates reporting: The GATHER statement. *The Lancet/PLOS Medicine*.

**L. Alkema**, A. Asafi, A. Bankole, B. Ganatra, C. Gerdtts, H. Johnston, A. Popinchalk, C. Rossier, S.D. Singh, O. Tunçalp, P. Van Look, G. Sedgh (2015). Estimating Global Abortion Incidence from 1990 until 2015 Using Bayesian Methods and a Framework of Abortion Determinants. Conference paper for Annual meeting of the Population Association of America, San Diego.

A.E. Raftery, **L. Alkema**, P. Gerland, S. J. Clark, F. Pelletier, T. Buettner, G. Heilig, N. Li, H. Sevcikova (2009). White Paper: Probabilistic Projections of the Total Fertility Rate for the 2010 World Population Prospects. <http://www.un.org/esa/population/meetings/EGM-Fertility2009/egm-fertility2009.html>

A.E. Raftery, **L. Alkema** (2008). Discussion on the paper "Estimates of human immunodeficiency virus prevalence and proportion diagnosed based on Bayesian multiparameter synthesis of surveillance data" by Goubar et al. *Journal of the Royal Statistical Society: Series A* 171(3): 541–580.

**L. Alkema**, O. Faye, M. Mutua, E. Zulu (2008). Identifying Poverty Groups in Nairobi's Slum Settlements: A Latent Class Analysis Approach. Conference paper for Annual meeting of the Population Association of America, New Orleans. <http://paa2008.princeton.edu/abstractViewer.aspx?submissionId=80116>

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## METHODOLOGICAL CONTRIBUTIONS TO GLOBAL MONITORING

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*Listed below are results from collaborative research projects with references to associated reports or organizations that utilized the methods developed.*

### Abortion and unintended pregnancies

- Main methods: Bayesian demographic accounting model for estimating abortions and unintended pregnancies; Bayesian hierarchical model for estimating abortion safety.
- References: Guttmacher Institute and WHO reporting on abortions and unintended pregnancies globally since 2016. See <https://www.guttmacher.org/global/abortion>.

### Child mortality

- Main methods: Bayesian penalized B-spline regression model for estimating mortality; Bayesian hierarchical time series model for estimates mortality sex ratios.
- References: United Nations Inter-agency Group for Child Mortality Estimation (since 2012). Levels & Trends in Child Mortality.

### Family planning

- Method: Bayesian hierarchical time series model for estimation and projection for family planning indicators for married women.
- References:
  - United Nations Population Division (since 2013). Estimates and Projections of Family Planning Indicators;
  - Family Planning Estimation Tool (FPET), used for FP2020 and FP2030 monitoring. See <https://fp2030.org/data-hub/progress>.

### Fertility

- Method: Probabilistic projection method for the total fertility rate.
- References: United Nations Population Division (since 2011). World Population Prospects.

### HIV prevalence

- Method: Bayesian melding approach for estimating HIV prevalence in generalized epidemics.
- Reference: UNAIDS (2007). 2007 AIDS epidemic.

### Maternal mortality

- Main methods: Bayesian maternal mortality estimation model (BMat); Bayesian bivariate random walk model for sensitivity and specificity in reporting of maternal mortality in vital registration data (since 2019).
- References: UN Maternal Mortality Estimation Inter-Agency Group (2014, 2015, 2019). Trends in maternal mortality. Estimates by WHO, UNICEF, UNFPA, World Bank and the UN Population Division.

### Stillbirths

- Main method: Bayesian sparse regression model with temporal smoothing
- Reference: United Nations Inter-agency Group for Child Mortality Estimation (2020). Hidden in Plain Sight: The Global Burden of Stillbirths.

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## OPEN SOURCE SOFTWARE

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**L. Alkema** (2019). Software for fitting the Bayesian maternal mortality estimation model (BMat). Available at [www.who.int/reproductivehealth/publications/maternal-mortality-2000-2017/en/](http://www.who.int/reproductivehealth/publications/maternal-mortality-2000-2017/en/).

**L. Alkema**, CH Lee, H. Susmann (2023). Sexual Activity and Family Planning Estimation Tool *SA-FPET*: R package for Bayesian modeling of time-since-last-sex. Available at <https://github.com/AlkemaLab/safpet>

G. Guranich, M. Wheldon, N. Cahill, **L. Alkema** (2020). *fpemlocal*: The local implementation of the Family Planning Estimation Model. Available at <https://github.com/AlkemaLab/fpemlocal>  
*Note: This package forms the basis of the Family planning estimation tool used for FP2030 reporting, available at [fpet.track20.org](http://fpet.track20.org).*

G. Guranich, E. Peterson, **L. Alkema** (in preparation for public release for UN MMEIG 2023 release of maternal mortality estimates). *Bmat/Bmis*: An R Package for estimating misclassification of maternal deaths in CRVS systems and fitting the Bayesian maternal mortality estimation model.

H. Ševčíková, **L. Alkema**, A. Raftery (2011). *bayesTFR*: An R Package for Probabilistic Projections of the Total Fertility Rate. Available at [cran.r-project.org/web/packages/bayesTFR](http://cran.r-project.org/web/packages/bayesTFR).

H. Susmann and **L. Alkema** (2023). *BayesTransitionModels*: R package for fitting Bayesian transition models for demographic and health indicators. Available at <https://github.com/AlkemaLab/BayesTransitionModels>

M. Wheldon, J.R. New, N. Cahill, G. Guranich, C. Wei, A. Tait, K. Bietsch, **L. Alkema** (2019). *FPemGlobal*: An R Package for producing global estimates and projections of contraceptive use, unmet need for family planning, met need for family planning, and other family planning indicators for all (married/partnered and unmarried) women. Available at [github.com/FPcounts/FPemGlobal](https://github.com/FPcounts/FPemGlobal).

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## TEACHING EXPERIENCE AND ADVISING

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### Online training materials:

Course materials and recordings for Applied Bayesian Statistical Modeling are available at <https://leontinealkema.github.io/bayes/>

### Courses taught:

University of Massachusetts Amherst, Department of Biostatistics and Epidemiology, USA

- Applied Bayesian Statistical Modeling:
  - Applied Bayesian Statistical Modeling (BIOSTATS 730), Spring 2017, Spring 2018, Fall 2022.
  - Bayesian computation in biostatistics (BIOSTATS 697G), Spring 2016.
- Topics in Biostatistics and Data Science in Public Health (BIOSTATS 690P), Spring 2021
  - Responsible for course development, coordination, and co-teaching.
- Various courses related to Statistical Computing with R:
  - Introduction to Statistical Computing with R (PUBLIC HEALTH 490R), Fall 2019, Fall 2020.
  - Introduction to Statistical Computing with R (BIOSTATS 597D), Fall 2018, Fall 2019, Fall 2020.
  - Intermediate Statistical Computing with R (BIOSTATS 597E), Fall 2019, Fall 2020.
  - Advanced Statistical Computing with R (BIOSTATS 597A), Fall 2019, Fall 2020.
  - Advanced R for Data Science (BIOSTATS 690R), Fall 2018.

National University of Singapore, Department of Statistics and Applied Probability, Singapore

- Applied regression analysis (ST5202), Spring 2010 and Spring 2011.
- Applied time series analysis (ST3233), Fall 2013 and Fall 2014.
- Demographic methods (ST3244), Fall 2010, Fall 2011 and Spring 2013.
- Regression analysis (ST3131), Spring 2010 and Spring 2012.
- Survival analysis (ST5212), Spring 2015.

UC Berkeley, Department of Demography, USA

- Advanced demographic analysis (Demography 211), Spring 2014.

Columbia University, Department of Statistics, New York, USA

- Linear regression models (W4315), Spring 2009.

### Other classroom instruction:

- Fall 2019: Guest lecture on estimating maternal mortality for Public Health 492E, an undergraduate research seminar course to provide students with an understanding of current public health research. University of Massachusetts Amherst.
- Spring 2018: Guest lectures on Bayes rule and estimating child mortality for Public Health 200 Introduction to Public Health. University of Massachusetts Amherst.
- Applied linear regression analysis (Short course), May 2012. Soochow University, School of Mathematical Science, Suzhou, China

## Mentorship

Graduate and postdoctoral advising (Chair of committee) at UMass Amherst, unless noted otherwise:

Period	Name	Degree	Notes
2022 –	Lucas Godoy Garraza	PhD	<i>Topic:</i> Causal inference with applications to impact assessment related to family planning
2021 –	Jadey Wu	PhD	<i>Topic:</i> Bayesian hierarchical and spatial modeling; Bayesian workflow in sparse data settings
2018 – 22	Herb Susmann	PhD	<i>Title:</i> Bayesian Hierarchical Temporal Modeling and Targeted Learning with Application to Reproductive Health
2016 – 23 (expected)	Chuchu Wei	PhD (part-time)	<i>Title:</i> Improved use of compositional data subject to self-reporting errors in Bayesian models
2018 – 21	Zhengfan Wang	PhD	<i>Title:</i> Development of Bayesian hierarchical temporal sparse regression models for prediction in data-limited settings <i>Current position:</i> Postdoc, UMass Amherst
2015 – 19	Emily Peterson	PhD	<i>Title:</i> Bayesian methods for the assessment of reporting errors for data-sparse population-periods with applications to estimating mortality. <i>Current position:</i> Research Assistant Professor in Biostatistics, Emory University.
2013 – 17	Fengqing Chao	PhD NUS	<i>Title:</i> Methods for estimating global health indicators. <i>Current position:</i> Research scientist, KAUST, Saudi Arabia.
2016 – 17	Niamh Cahill	Postdoc advisor	<i>Current position:</i> Assistant Professor in Statistics, Maynooth University, Ireland.
2020 – 21	Barbara Mottley	MS	<i>Title:</i> Subnational analysis of birth weight in Ghana using Bayesian spatial regression models <i>Current:</i> PhD student, Environmental Health Sciences
2017 – 19	Greg Guranich	MS	<i>Title:</i> Estimating age-specific contraceptive use for spacing of childbirth for all countries in Sub-Saharan Africa from 1985 to 2030 using a Bayesian hierarchical time series model. <i>Current position:</i> Consultant, World Health Organization
2016 – 18	Zhenning Kang	MS	<i>Title:</i> Categorizing abortions by safety category: A Bayesian hierarchical modeling approach. <i>Current position:</i> Data scientist, Holyoke Medical Group.

Chair of Honor's theses at the National University of Singapore:

- 2014 – 15 Michael Linardi Tanny, Tan Yu Wen Joanne and Chen Yunjin (Estimating inequality in child mortality).
- 2012 – 13 Wu Jinxian (Estimating age patterns of child mortality), Neo Soo Khee and Goh Wei Xian (Estimating fertility rates).
- 2011 – 12 Jin Rou New (Estimating child mortality; NJR received the NUS Outstanding Undergraduate Researcher Prize), Fengqing Chao (Estimating and validating measures of maternal mortality), Stella Ting (Estimating gender biases in child mortality).
- 2010 – 11 Maria Wong, Pei Rong Seah, Zhuang Dingxuan (Validating child mortality estimates).
- 2009 – 10 Wei Ling Ann (Estimating child mortality), Choo Shao Ying (Poverty in Kenya).

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## PROFESSIONAL ACTIVITIES AND SERVICE

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### Departmental/University service at UMass Amherst

- 2022 – Chair, Biostatistics Curriculum Committee
- 2022 – Chair Biostatistics Graduate Advisory Committee
- 2022 – Member, School of Public Health and Health Sciences Personnel Committee
- 2018 – 2021 Biostatistics Program Head (co-head in 2018/19)
- 2020 – 2021 Member, Biostatistics Curriculum Committee
- 2019 – 2020 Member (Fall) and Chair (Spring), Departmental Personnel Committee
- 2018 – 2020 Chair (18/19) and Member (19/20), Biostatistics Graduate Advisory Committee
- 2018 – 2019 Member, Biostatistics Master's degree Development Committee
- 2017 – 2019 Chair, Biostatistics Curriculum Committee
- 2017 – 2018 Member, Biostatistics Faculty Search Committee
- 2016 Member, organizing committee for Computational Social Science Institute mixer
- 2015 – 2017 Member, Biostatistics Admissions Committee
- 2015 – 2016 Member, Biostatistics Faculty Search Committee

### Departmental/University service at the National University of Singapore

- 2014 – 2015 Member, undergraduate Statistics curriculum committee
- 2012 – 2013 Member, organizing committee for the Third Singapore Conference on Statistical Science
- 2009 – 2012 Member, consulting center committee, Department of Statistics and Applied Probability

### International service

- 2021 – Member, Subject Matter Expert Group for Institute for Health Metrics and Evaluation (IHME) Maternal Mortality Drivers research project
- 2021 – Member, World Health Organization Reference Group on Health Statistics Task Force on reporting guidelines for global health estimation (GATHER)
- 2021 – Member, Technical Advisory Group of the United Nations Maternal Mortality Estimation Inter-agency Group (UN MMEIG)
- 2019 – Member, World Health Organization Reference Group on Health Statistics.
- 2021 – Technical advisor to the FP2030 Performance Monitoring & Evidence Working group for the Family planning 2030 initiative, see <https://fp2030.org/performance-monitoring-and-evidence-working-group>
- 2011 – Member, technical advisory group of the United Nations Inter-agency Group on Child Mortality Estimation (UN IGME, agencies involved: UNICEF, WHO, UN Population Division and the World Bank).
- 2019 – 2021 Technical advisor to the FP2020 Performance Monitoring & Evidence Working group for the Family planning 2020 initiative
- 2014 – 2016 Member, World Health Organization working group on reporting of global health indicators.

### Other professional activities

- 2022 – Deputy Editor for *Demography*.
- 2014 – 2022 Associate Editor for *The Annals of Applied Statistics*.
- 2019 Organizer for invited session “Demographic Estimation for Monitoring and Decision making in Sparse-Data Settings” at the annual meeting of the Population Association of America in Denver, 2019.

2013 – 2014 Organizer of two sessions on statistical demography at the annual meeting of the Population Association of America in Boston, 2014.

#### Ad hoc reviewer

Statistics journals: *The Annals of Applied Statistics; Statistics, Politics and Policy; Statistica Sinica.*

Demography journals: *Demography; Demographic Research; Population Studies; Asia Population Studies.*

Global health: *New England Journal of Medicine; The Lancet; The Lancet Global Health; BMJ Global Health; BMJ Open; WHO Bulletin; Contraception; Health and Nutrition; PLOS Medicine; Sexually Transmitted Infections.*

Other: *Proceedings of the National Academy of Sciences; Studies in Family Planning; PLOS ONE.*

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### SELECTED PRESENTATIONS

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#### International and national invited presentations and oral conference presentations

##### *2021 onwards*

- FemQuant virtual seminar series (5/2023), see <https://www.youtube.com/watch?v=CFADAtZbDqo>
- Royal Society meeting on Forecasting natural and social systems, London UK (3/2023)
- European Population Conference, The Netherlands (6/2022)
- MAP5 Colloquium, Universite de Paris, France (6/2022)
- International Conference on Multilevel Analysis, The Netherlands (4/2022)
- Complex Data Modeling Research Network (<https://midas.mat.uc.cl/network/>) MiDaS Seminar series, Chile (7/2021)
- 41<sup>st</sup> Conference on Applied Statistics, Ireland (5/2021)
- University of Washington, Department of Statistics Working group in Applied, Bayesian and Computational Statistics (5/2021)
- Pennsylvania State University, Department of Statistics Colloquium (3/2021)

##### *2015-2020*

- Measuring Average Sexual Exposure (4/2020). Population Association of America Annual meeting (virtual).
- Bayesian modelling in action: monitoring family planning indicators (6/2020). Berkeley 2020 workshop on formal demography.
- Got data? Quantifying the contribution of population-period-specific information to model-based estimates (4/2020). MRP Conference, Columbia University.
- Estimating time trends for the World Population Prospects 2021: Lessons learned from model development for under-5 mortality and other demographic indicators (4/2020). Expert Group Meeting on "Methods for the World Population Prospects 2021 and beyond".
- Monitoring maternal mortality by the United Nations: improved estimates of levels, trends and reporting errors through Bayesian multilevel temporal regression modeling (08/2019). Joint Statistical Meetings, Denver.
- Sensible Statistics for the Social Sciences: How to estimate a population proportion if data are subject to unknown misclassification error? CSSS 20th Anniversary Conference (5/2019). Center for Statistics in the Social Sciences, University of Washington, Seattle.

- Small area estimation of family planning indicators using the Family Planning Estimation Tool (4/2019). Population Association of America Annual meeting, Austin.
- Model-Based Estimates in Demography and Global Health: Quantifying the Contribution of Population-Period-Specific Information (04/2019). Population Association of America Annual meeting, Austin.
- Discussion of Demographic Estimation for Monitoring and Decision making in Sparse-Data Settings (04/2019). Population Association of America Annual meeting, Austin.
- Model-Based Estimates in Demography and Global Health: Quantifying the Contribution of Population-Period-Specific Information (2019). New England Statistics Symposium.
- Model-based estimates in demography and global health: quantifying the contribution of population-period-specific information (08/2018). Joint Statistical Meetings, Vancouver, Canada (topic-contributed session).
- Statistics Department colloquium (10/2017). Harvard University.
- To space or to limit? An Assessment of Levels and Trends in Unmet Need for Limiting and Spacing From 1990 to 2030 in the World's Poorest Countries Using a Bayesian Hierarchical Time Series Model (04/2018) Population Association of America Annual meeting, Denver.
- A Bayesian approach to the global estimation of maternal mortality (6/2016). International Society for Bayesian Analysis 2016 world meeting, Sardinia, Italy (topic-contributed session).
- Subnational Rates and Trends in Contraceptive Prevalence and Unmet Need for Family Planning from 1990 to 2020: An Analysis for All 29 States in India (4/2016). Annual Meeting of the Population Association of America, Washington D.C.
- Trends in maternal mortality 1990-2015: Estimates developed by WHO, UNICEF, UNFPA, the World Bank and UNPD (3/2016). WHO Reference Group on Global Health Statistics (RGHS), Geneva, Switzerland.
- Bongaarts goes Bayesian (11/2015). Sussmilch lecture at the Max Planck Institute for Demographic Research, Rostock, Germany.
- Statistical Modeling in Global Health: A Selection of Recent Developments and Future Opportunities in Child, Maternal and Reproductive Health (10/2015). Computational Social Science Institute seminar, University of Massachusetts Amherst.

#### Selected presentations before 2015

*Summarized by topic, all presentations are talks unless noted otherwise.*

#### Estimating Gender Differences in Child Mortality

- Annual Meeting of the Population Association of America, Boston (4/2014)
- IUSSP International Population Conference, Busan, South Korea (9/2013)
- Annual Meeting of the Population Association of America, New Orleans (4/2013, poster)

#### Estimating Child Mortality

- Annual Meeting of the Population Association of America, Boston (4/2014, poster award)
- UC Berkeley, Department of Statistics seminar (4/2014)
- UC Berkeley, Department of Demography seminar (3/2014)
- IUSSP International Population Conference, Busan, South Korea (9/2013)
- Joint Statistical Meetings, Montreal (8/2013)
- Annual Meeting of the Population Association of America, Washington D.C. (4/2011)

#### Estimates and Short-term Projections of Unmet Need for Contraceptives



- Annual Meeting of the Population Association of America, Washington D.C. (4/2011, poster)
- Second Singapore Conference on Statistical Science, Singapore (4/2011)

#### Urbanization (Probabilistic Projections/Alternative Estimates/City Projections)

- Annual Meeting of the Population Association of America, Washington D.C. (4/2011, poster)
- Asian Population Association Conference, Bangkok, Thailand (8/2012, poster)
- Annual Meeting of the Population Association of America, San Francisco (4/2012, poster)

#### Probabilistic Projections of Fertility

- IUSSP International Population Conference, Busan, South Korea (9/2013)
- Annual Meeting of the Population Association of America, New Orleans (4/2013, poster)
- Expert Group Meeting on Recent and Future Trends in Fertility, United Nations Population Division, New York (12/2009)
- IUSSP International Population Conference, Marrakech, Morocco (9/2009)
- Joint Statistical Meetings, Denver (8/2008)
- Earth Institute Fellows Symposium, Columbia University, New York (11/2008)
- Annual meeting of the Pacific Institute for the Mathematical Sciences collaborative research group on Bayesian modeling and computation for networks, Washington State (5/2008)
- Annual Meeting of the Population Association of America, New Orleans (4/2008)
- Center for Demography and Ecology Seminar Series, University of Washington, Seattle (11/2007)
- Centre for Actuarial Research (CARE), University of Cape Town, South Africa (8/2007)
- United Nations Population Division, New York (4/2007)

#### Assessing Uncertainty in Fertility Estimates in Western Africa

- IUSSP International Population Conference, Marrakech, Morocco (9/2009)
- Annual meeting of the Population Association of America, Detroit (4/2009)
- Human Mortality Database Symposium, Max Planck, Rostock, Germany (6/2008)

#### Identifying Poverty Groups in Nairobi's Slum Settlements: A Latent Class Analysis Approach

- Annual Meeting of the Population Association of America, New Orleans (4/2008)
- INDEPTH annual conference and scientific meeting, Nairobi, Kenya (9/2007)
- African Population and Health Research Center, Nairobi, Kenya (6/2007)

#### Probabilistic Projections of HIV Prevalence using Bayesian Melding

- Workshop on Epidemiology of Infectious Diseases, IMS, Singapore (1/2010)
- Annual Meeting of the Actuarial Society South Africa, Cape Town (8/2007)
- Medical Council South Africa, Cape Town (7/2007)
- Annual Meeting of the Population Association of America, New York (4/2007)
- African Population and Health Research Center, Nairobi, Kenya (1/2007)
- International Workshop on Data, Algorithms and Decision Making, Trest, Czech Rep. (12/2006)
- UNAIDS reference group technical meeting, London, UK (10/2006)
- Statistical Center for HIV/AIDS Research and Prevention, Fred Hutchinson, Seattle (2/2006)