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Field-deployable immunodiagnostics for poverty-associated infectious diseases: development and use cases in public health

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Dankwoord

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Curriculum vitae

Louise Pierneef was born on the 14th of May 1994, in Heemskerk, the Netherlands. From 2006 to 2012, she attended Jac. P. Thijssen College in Castricum, where she completed her pre-university education (VWO) with a Nature and Health profile. In 2012, she enrolled in the Bachelor's program in Health and Life Sciences at the Vrije Universiteit (VU) in Amsterdam. During her Bachelor studies, she gained hands-on research experience through an internship at the Department of Pathology at the Leiden University Medical Center (LUMC), where she focused on diabetic nephropathy. She continued her academic journey by pursuing a Master's degree in Biomedical Sciences (VU Amsterdam). In the first year of the program, she specialized in Neurobiology. As part of her training, she undertook an internship at the Netherlands Brain Institute, where she contributed to a project investigating demyelination and inflammation mediated by microglia and macrophages in multiple sclerosis. In the second year of her Master's studies, Louise shifted her focus to Immunology and completed an internship at the Department of Infectious Diseases at the LUMC, within the research group of Prof. Dr. Annemieke Geluk. Her work during this period centered on the transmission of *Mycobacterium leprae* and the early diagnosis of leprosy reactions. After completing her Master's in Biomedical Sciences in 2018, Louise pursued a second Master's degree in International Public Health (IPH; VU Amsterdam). During this program, she continued her work on leprosy, conducting qualitative research in Nepal for four months. Her research, carried out in collaboration with the Netherlands Leprosy Relief, investigated factors influencing the mental wellbeing of individuals affected by leprosy. Upon completing her Master's in IPH in 2019, Louise returned to the research group of Prof. Dr. Annemieke Geluk at the LUMC, where she was appointed as a junior researcher. In August 2021, she began her PhD research, focusing on field-friendly immunodiagnosics for poverty-associated infectious diseases. This work was conducted in close collaboration with the research group of Dr. Ir. Paul Corstjens at the Department of Cell and Chemical Biology. The results of her doctoral research are presented and discussed in this thesis and have been published in international scientific journals.

List of publications

1. Tió-Coma M, Wijnands T, **Pierneef L**, Schilling AK, Alam K, Roy JC, Faber WR, Menke H, Pieters T, Stevenson K, Richardus JH, Geluk A. Detection of *Mycobacterium leprae* DNA in soil: multiple needles in the haystack. *Sci Rep*. 2019 Feb 28;9(1):3165.
2. Tió-Coma M, Avanzi C, Verhard EM, **Pierneef L**, van Hooij A, Benjak A, Roy JC, Khatun M, Alam K, Corstjens P, Cole ST, Richardus JH, Geluk A. Genomic Characterization of *Mycobacterium leprae* to Explore Transmission Patterns Identifies New Subtype in Bangladesh. *Front Microbiol*. 2020 Jun 16;11:1220.
3. **Pierneef L**, van Hooij A, Taal A, Rumbaut R, Nobre ML, van Brakel WH, Geluk A. Detection of anti-*M. leprae* antibodies in children in leprosy-endemic areas: A systematic review. *PLoS Negl Trop Dis*. 2021 Aug 27;15(8):e0009667.
4. Zhou Z, Pena M, van Hooij A, **Pierneef L**, de Jong D, Stevenson R, Walley R, Corstjens PLAM, Truman R, Adams L, Geluk A. Detection and Monitoring of *Mycobacterium leprae* infection in Nine Banded Armadillos (*Dasypus novemcinctus*) Using a Quantitative Rapid Test. *Front Microbiol*. 2021 Oct 28;12:763289.
5. **Pierneef L**, van 't Noordende AT, Bista M, Singh U, Scheltema MB, Joshi AK, Pant M, Shakya L, Waltz MM, van Brakel WH. Factors influencing the mental wellbeing of persons affected by leprosy in Far-Western Nepal. *Lep Rev*. 2022 March 1;93;1:12-25.
6. Zhou Z, **Pierneef L**, van Hooij A, Geluk A. Detection of anti-*M. leprae* antibodies in healthy children in China: A systematic review of Chinese literature. *Front Trop Dis*. 2022 Oct 7;3:963674.
7. **Pierneef L**, van Hooij A, de Jong D, Tjon Kon Fat EM, van Meijgaarden KE, Petruccioli E, Vanini V, Roukens AHE, Goletti D, Corstjens PLAM, Joosten SA, Geluk A; BEAT-COVID study group. Host biomarker-based quantitative rapid tests for detection and treatment monitoring of tuberculosis and COVID-19. *iScience*. 2023 Jan 20;26(1):105873.
8. Khalid H*, **Pierneef L***, van Hooij A, Zhou Z, de Jong D, Tjon Kon Fat E, Connelley TK, Hope JC, Corstjens PLAM, Geluk A. Development of lateral flow assays to detect host proteins in cattle for improved diagnosis of bovine tuberculosis. *Front Vet Sci*. 2023 Aug 15;10:1193332.
9. **Pierneef L**, Malaviya P, van Hooij A, Sundar S, Singh AK, Kumar R, de Jong D, Meuldijk M, Kumar A, Zhou Z, Cloots K, Corstjens PLAM, Hasker E, Geluk A. Field-friendly anti-PGL-I serosurvey in children to monitor *Mycobacterium leprae* transmission in Bihar, India. *Front Med*. 2023 Sep 27;10:1260375.
10. **Pierneef L**, van Hooij A, de Jong D, Wassenaar G, Verhard E, Tjon Kon Fat E, Engel N, Khatun M, Soren S, Chowdhury AS, van Hees C, Corstjens PLAM, Geluk A. Rapid test for *Mycobacterium leprae* infection: a practical tool for leprosy. *Infect Dis Poverty*. 2024 Dec 2;13(1):88.
11. Zhou Z, van Hooij A, van Dijk JHM, Musch N, **Pierneef L**, Khalid H, Franken K, Holder T, Watt N, Michel AL, Codée JDC, Vordermeier M, Corstjens PLAM, van der Heijden EMDL, Hope JC, Geluk A. Anti-phenolic glycolipid antibodies in *Mycobacterium bovis* infected cattle. *One Health*. 2025 Jan 28;20:100982.
12. **Pierneef L**, Braet SM*, de Jong D*, Ramboarina S, van Hooij A, Abdou MW, Ortuno-Gutierrez N, Snijders R, Maharavo L, Grillone SH, Andriamira R, Andrianarivelo R, Rasamoelina T, Hasker E, Corstjens PLAM, de Jong BC, Cauchois B, Assoumani Y, Geluk A. Large-scale field application of a fingerstick blood test for *Mycobacterium leprae* infection: Monitoring population-wide effects of case finding and post-exposure prophylaxis on transmission in the Comoros and Madagascar. *PLOS Glob Pub Health*. 2025 Dec 2;5(12):e0005270.
13. **Pierneef L**, Muhammad M, Wassenaar G, Edbert D, Krismawati H, Wahyuni S, Ali S, Kaisar MMM, Corstjens PLAM, Geluk A. Seroprevalence of anti-*Mycobacterium leprae* PGL-I antibodies among school children in rural and urban Indonesia: a cross-sectional study (2023). *The Lancet Reg Health SEA*. 2026 Jun; 49:100779.

*Contributed equally

Portfolio

During my PhD, I was part of the Leiden University Center for Infectious Diseases department, working under the supervision of Prof. Dr. A. Geluk (primary advisor) and Dr. Ir. P.L.A.M. Corstjens (co-advisor). My thesis, titled “*Field-deployable immunodiagnostics for poverty-associated infectious diseases: development and use cases in public health*”, focuses on the development and evaluation of diagnostic tools for diseases such as tuberculosis and leprosy. This chapter outlines the academic training, dissemination activities, and teaching experiences I undertook during my PhD trajectory.

My training started in 2020 with the course *Basic Methods and Reasoning in Biostatistics*, which provided a strong foundation in data analysis. In 2021, I completed the *Leiden University Onboarding Programme* and attended the *LAP PhD Day*, introducing me to the broader academic environment and connecting me with other early-stage researchers.

In 2022, I deepened my scientific knowledge by participating in the *LIFI course* and attending multiple national and international conferences, including the *LRI congress 2022*, *ILC 2022*, and *NVVI 2022*. I also was able to engage in field work and provide a lab training in Brazil as part of the LRI BraBo project (**Chapter 8**), and later that year, at the National Institute for Infectious Diseases “L. Spallanzani”, IRCCS, in Rome, Italy (**Chapter 7**). Additionally, in 2022, I supervised a BSc student (Biomedical sciences) during her internship, providing guidance and support throughout her research project. These experiences contributed to my development as a collaborative and globally engaged researcher.

The year 2023 was marked by an expansion in both research dissemination and teaching activities. I attended the *Leprosy Research Initiative (LRI) congress 2023* in Eindhoven and the *Global Research on Worldwide challenges (GROW) congress 2023* in Soesterberg. I also presented during a *LU-CID* session and delivered lab trainings to project collaborators in Bolivia and Indonesia. A major highlight was my supervision of the half minor *Infections in Health and Disease* during a field trip in October 2023 in South Sulawesi, Indonesia (**Chapter 5**). I was one of the supervisors to a group of medical students from the Netherlands and Indonesia - supporting them in conducting field research, laboratory work, data analysis and presentation and report writing. This role involved coordinating activities, troubleshooting challenges in real time, and fostering cross-cultural scientific collaboration. In addition to this, I supervised an MSc student (Biomedical sciences) during her internship (acquiring data for **Chapter 3**) and assessed students during the *FOS* journal club course. Furthermore, I supported a PhD student from Edinburgh during his exchange in Leiden by assisting in the setup and development of assays for his project on bovine TB. Beyond this, I provided guidance and assistance to three other international PhD students visiting Leiden for exchanges or internships, helping them with various aspects of their research projects. These experiences sharpened my mentorship skills and strengthened my ability to communicate scientific concepts across different academic levels.

In 2024, I participated in and presented at the *Workshop on Research on Tuberculosis and Leprosy* and the *Theme Infection Meeting*. I also completed the *Responsible Research* training, including a *Workshop on Scientific Conduct for PhDs*, both of which reinforced the importance of ethics and integrity in science. I also supported two international PhD students and contributed to their research progress as part of a collaborative research team.

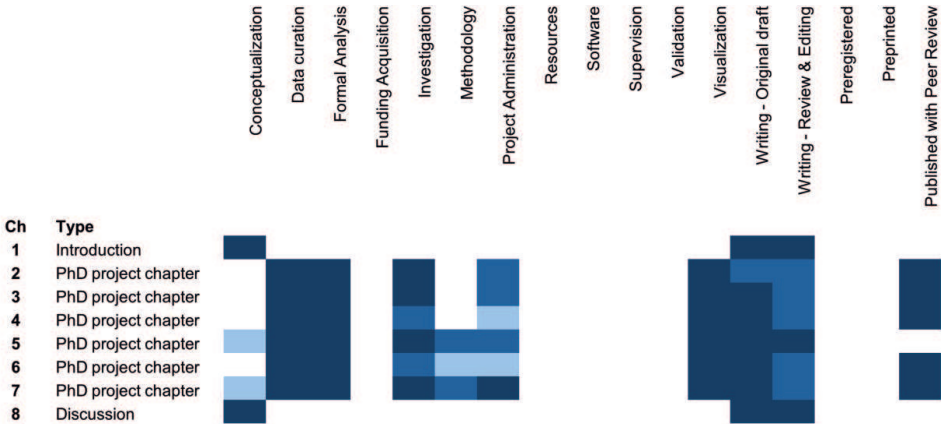
Additionally, I gave a presentation at the *LiTBC meeting*, contributing to broader institutional knowledge exchange.

The final year of my PhD, 2025, included attendance at the *LRI congress 2025* and the *ILC 2025*, where I shared the final outcomes of my work. To support my attendance and presentation at ILC 2025, I successfully applied for and received a travel grant from the *Leiden University Fund (LUF)*. The ILC conference was a significant milestone in my PhD journey, providing an excellent platform not only to present my research findings but also to engage in a wide range of scientific and political discussions. Additionally, I participated in numerous networking dinners and meetings, which gave me valuable insights into the broader impact of immunodiagnostics and infectious disease research on global health policy. This conference truly marked a meaningful culmination of my PhD trajectory, integrating scientific communication, interdisciplinary collaboration, and career development.

Across my PhD trajectory, I regularly attended theme meetings, internal lectures, and LUMC presentations, which allowed me to stay connected to ongoing developments and to contribute to interdisciplinary discussions. In addition, my training and dissemination activities included diverse teaching responsibilities, active participation in national and international scientific meetings, and the delivery of hands-on laboratory training to collaborators in Brazil, Bolivia and Indonesia. These international training activities were particularly formative, as they enabled me to apply my scientific expertise in collaborative, real-world settings and to contribute to capacity building among research partners.

Overall, my PhD journey has been shaped not only by research, but also by teaching, extensive global collaboration, and scientific exchange. Successfully obtaining external funding to present my work at a major international conference, alongside supervising students and supporting collaborative research and training activities, reflects my development into an independent and proactive researcher.

CRediT statement for the Chapters in this thesis



Dissemination table

1. Pierneef et al. Detection of anti-M. leprae antibodies in children in leprosy-endemic areas: a systematic review	
Chapter in this thesis	2
Publication in peer-reviewed journal	https://pubmed.ncbi.nlm.nih.gov/34449763/
2. Pierneef et al. Host biomarker-based quantitative rapid tests for detection and treatment monitoring of tuberculosis and COVID-19	
Chapter in this thesis	7
Publication in peer-reviewed journal	https://pubmed.ncbi.nlm.nih.gov/36590898/
3. Pierneef et al. Field-friendly anti-PGL-I serosurvey in children to monitor Mycobacterium leprae transmission in Bihar, India	
Chapter in this thesis	4
Publication in peer-reviewed journal	https://pubmed.ncbi.nlm.nih.gov/37828950/
4. Pierneef et al. Rapid test for Mycobacterium leprae infection: a practical tool for leprosy	
Chapter in this thesis	3
Publication in peer-reviewed journal	https://pubmed.ncbi.nlm.nih.gov/39617937/
5. Pierneef et al. Large-scale field application of a fingerstick blood test for Mycobacterium leprae infection: Monitoring population-wide effects of case finding and post-exposure prophylaxis on transmission in the Comoros and Madagascar	
Chapter in this thesis	6
Publication in peer-reviewed journal	https://pubmed.ncbi.nlm.nih.gov/41329688/
6. Pierneef et al. Seroprevalence of anti-Mycobacterium leprae PGL-I antibodies among school children in rural and urban Indonesia: a cross-sectional study (2023)	
Chapter in this thesis	5
Publication in peer-reviewed journal	https://pubmed.ncbi.nlm.nih.gov/42256252/

Overview of completed courses and other training

Completed courses and other training		
Mandatory activities		
Year	Title	EC / hours
2020	Basic Methods and Reasoning in Biostatistics	42
2021	Leiden University Onboarding Inform & Connect (2 activities)	5
2024	Responsible Research (2 activities)	20
Scientific courses, workshops and other training activities		
2021	LAP PhD day	6
2022	LIFI course	45
2025	Symposium "A Dutch perspective on mycobacterial infections"	8
2025	Symposium "Past, present and future of immunology in Leiden"	8
Dissemination, acknowledgement, esteem, and other relevant scientific activities		
2021	LRI Congress 2021	8
2022	NVVI (poster presentation)	24
2022	LRI Congress 2022 (oral presentation)	16
2022	ILC Conference 2022 (oral presentation)	24
2023	LRI Congress 2023 (oral presentation)	24
2023	GROW Congress 2023	16
2023	Presentation at LU-CID meeting	5
2024	Presentation at Workshop 'Research on Tuberculosis and leprosy'	4
2024	LRI Congress 2024 (oral presentation)	24
2024	Presentation at Theme Infection meeting	8
2024	Pitch presentation at WINNER	4
2024	Presentation at LiTBC meeting	4
2025	LRI Congress 2025 (oral presentation)	12
2025	ILC Conference 2025 (oral presentation)	30
Other activities related to this thesis		
2022	Lab training in Brazil to co-workers LRI BraBo project	4
2022	Lab training in Rome to co-workers	4
2022	Supervision of internship BSc student Biomedical Sciences	28
2022	Supervision of international PhD student	28
2023	Lab training in Bolivia to co-workers LRI BraBo project	4
2023	Lab training in Indonesia to co-workers	16
2023	Supervision of internship MSc student Biomedical Sciences	28
2023	Journal club assessment of students during FOS course	2
2023	Supervision of halfminor "Infections in Health and Disease"	84
2024	Supervision of international PhD student	28
2024	Supervision of International PhD student	28
Total number of hours		591