

A Pioneering Silicosis Screening Program for Mine Workers in Rural Rwanda

Implementation and Cost Analysis

Innocent Kamali¹, Robert Tumusime¹, Michael S. Miller², Anne Niyigena¹, Mwiseneza Phoebe³, Symaque Dusabeyezu¹, Paul Sonenthal^{4,5}, Pacifique Hagenimana¹, Samuel Hatfield⁶, Pierrot Constance Uwitonze¹, Emmanuel Harerimana¹, Marie Grace Umugiraneza¹, Aristarque Murara⁷, Fredrick Kateera¹, Vincent K. Cubaka¹

¹Partners In Health-Rwanda/Inshuti Mu Buzima, Rwinkwavu, Rwanda. ²Department of Medicine, Brigham and Women's Hospital, Boston, MA, USA. ³Rwinkwavu District Hospital, Kayanza, Rwanda. ⁴Division of Pulmonary and Critical Care Medicine, Brigham and Women's Hospital, Boston, MA, USA. ⁵Harvard Medical School, Boston, MA, USA. ⁶Department of Medicine, University of California at San Francisco, San Francisco, CA, USA. ⁷Wolfram Mining and Processing Ltd, Kigali, Rwanda.

BACKGROUND

Silicosis is an incurable interstitial lung disease caused by inhaling respirable crystalline silica, with mining as a primary risk factor. Despite extensive mining activities, the burden of silicosis in sub-Saharan Africa remains poorly understood. Additionally, the implementation processes and costs of occupational lung disease screening, including silicosis, in Rwanda and other low-resource settings are underreported.

METHODS

From June 2022 to February 2023, we implemented Rwanda's first silicosis case-finding program for small-scale and semi-industrial mine workers. The program included miner education, symptom screening, diagnostic tests, and linkage to care, along with a cost analysis. To improve cost-efficiency and care integration, we also included routine screening for diabetes and hypertension.



Figure 1: Educational Session for Miners on Silicosis Risk Factors

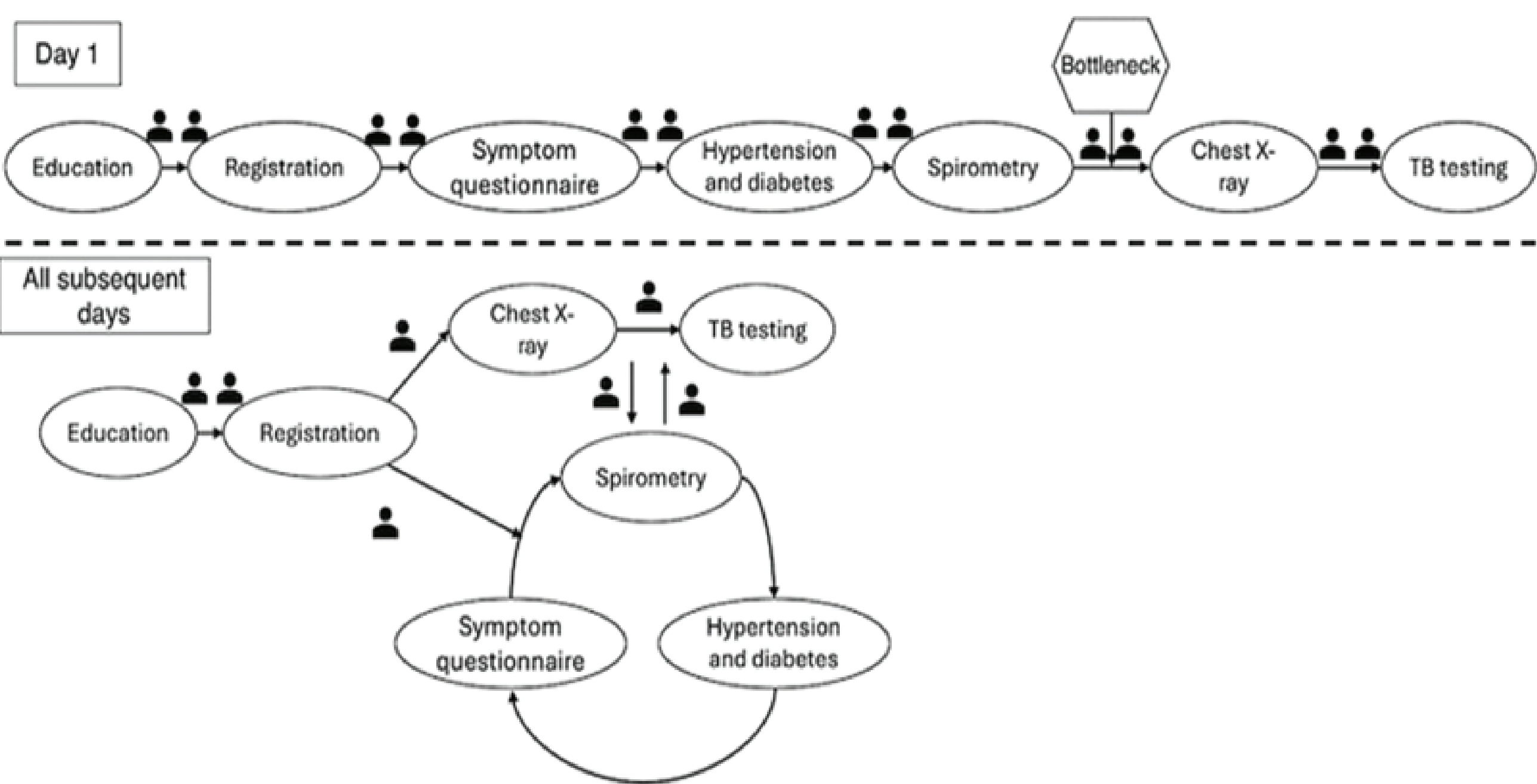


Figure 2: Flow of Silicosis Case-Finding Program Activities, Rwanda

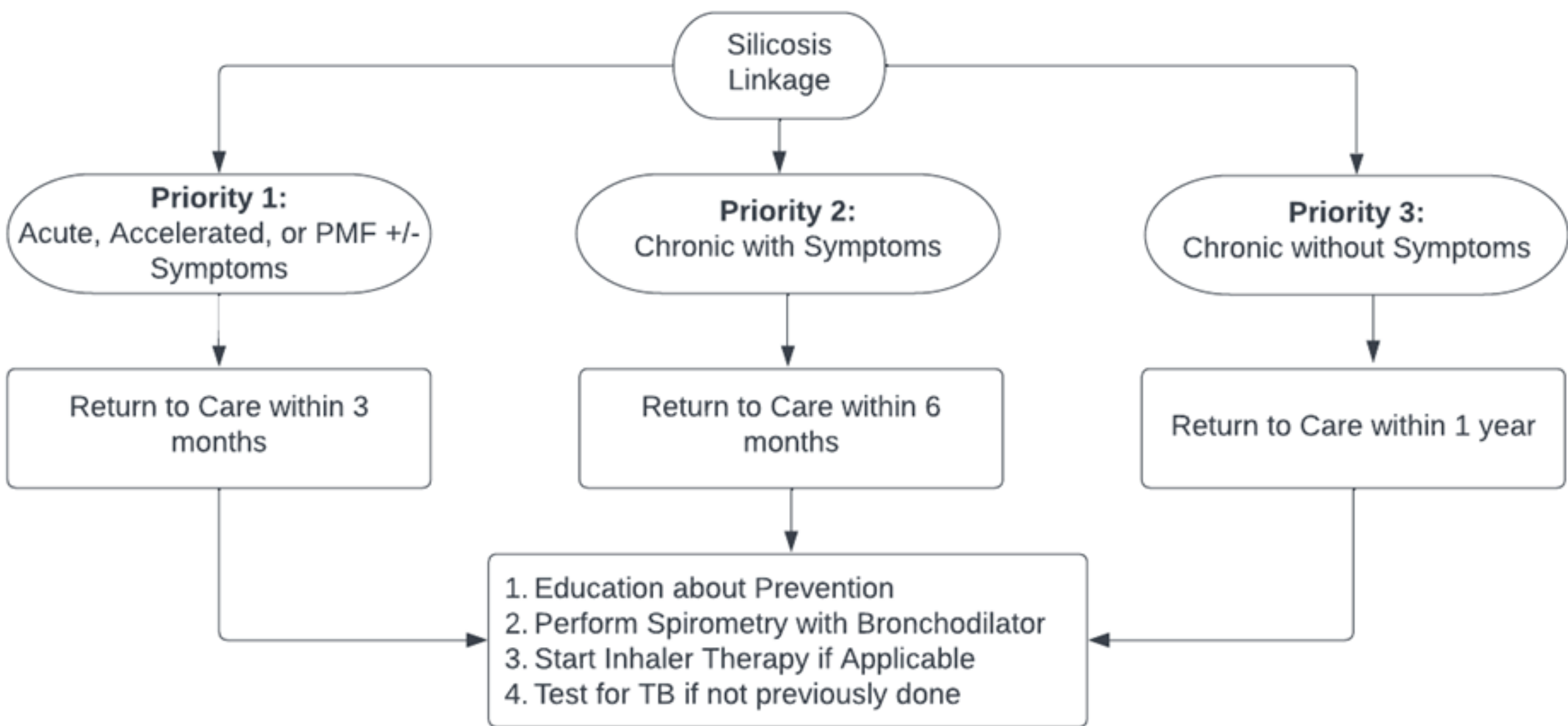


Figure 3: Care Pathway for miners with Suspected Silicosis

FINDINGS

Over 25 days, 1,032 mine workers participated, with 1,014 (98.3%) completing the silicosis screening. Among the participants, 95 (9.2%) showed radiographic evidence of silicosis, 221 (21.6%) screened positive for hypertension, and 12 (1.1%) had elevated glucose levels. The program's total cost was US\$38,656, averaging US\$37.49 per participant.

Category	Total Program	Total Cost Per
	Cost (USD)	Person Tested (USD)
Screening Staff	\$24,113.93	\$23.37
Training and Meeting Supplies	\$2,054.76	\$1.99
Transport	\$293.32	\$0.28
Data Collection Materials	\$306.59	\$0.30
Screening Day Refreshments	\$2,604.76	\$2.52
Medical Supplies and Materials	\$9,312.19	\$9.02
Totals	\$38,685.55	\$37.48

INTERPRETATION

Large-scale occupational lung disease case-finding is feasible and cost-effective in resource-limited settings, especially when integrated with routine NCD screening. Strengthening silicosis prevention among African mine workers requires collaboration between the private sector, the Ministry of Health, and NGOs. This initiative can inspire similar surveillance efforts in mining communities across low- and middle-income countries.

SOURCE OF FUNDING