

Telemedicine, Access, and Referral Burden in Guyana's Hinterland Regions: A Retrospective Study, 2022–2026

Aruna Faria*, Abiodun Olaiya Paul

School of Public Health, Texila American University, Guyana

Abstract

Healthcare access in Guyana's hinterland regions is constrained by geographic isolation, long travel distances, high transport costs, and limited specialist availability at peripheral facilities. Telemedicine has emerged as a strategy to bridge these gaps by enabling remote consultation, supporting local clinical decision-making, and reducing unnecessary patient referrals. This retrospective descriptive study analyzed annual program data and site-level operational records from the national telemedicine program across Guyana's hinterland from 2022 to 2026. Key indicators included communities served, telemedicine calls, patient visits, serious cases, critical care encounters, remote ultrasound examinations, medical evacuations, and hospital referrals eliminated. The program expanded from 4 communities in 2022 to 130 in 2026. Telemedicine calls increased from 55 to approximately 2,500, and patient visits from 84 to approximately 25,000. Patient visits per community rose from 21.0 in 2022 to 192.3 in 2026, indicating deepening service intensity beyond geographic expansion. Serious cases increased from 11 to approximately 850, critical care encounters reached approximately 200, and remote ultrasound use grew from 106 in 2024 to approximately 800 in 2026. Hospital referrals eliminated increased from 423 in 2024 to approximately 1,900 in 2026. Medical evacuations remained stable despite growing clinical volumes. These findings indicate that Guyana's hinterland telemedicine program achieved meaningful improvements in access, supported local management of complex clinical presentations, and contributed to referral burden reduction. Implementation quality and local integration appear to mediate utilization beyond geography alone. Future research should evaluate patient-level outcomes, referral appropriateness, and household cost savings.

Keywords: *Access to Healthcare, Guyana, Hinterland, Referral Burden, Telemedicine.*

Introduction

Healthcare Access in Guyana's Hinterland

Healthcare access in Guyana's hinterland regions is shaped by a geography that makes routine clinical contact extraordinarily difficult. The hinterland encompasses Regions 1, 7, 8, 9, and parts of Regions 5, and 10, covering vast forested and riverine territories with dispersed indigenous Amerindian communities connected by limited road networks, seasonal

river routes, and occasional airstrips. Travel to the nearest hospital from many hinterland communities [15, 17] requires between 4 and 14 working days of combined travel, imposes costs of GY\$6,000 to GY\$200,000 per round trip, and compels patients to lose multiple workdays [1, 2]. These structural barriers translate directly into avoidable delays in diagnosis and treatment, disrupted continuity of care for chronic conditions, and preventable deterioration in cases requiring timely specialist input.

Prior to scaling telemedicine, peripheral health posts in the hinterland were staffed predominantly by community health workers and medexes operating without specialist support, reliable diagnostic equipment, or functional referral communications. The default clinical response to any case exceeding local capacity was physical referral to Georgetown or district hospitals, a pathway that was costly, slow, and frequently declined by patients unable to bear the associated burden [3]. The result was a two-tier system in which the de facto quality of care available to hinterland communities was substantially lower than that in the coastal urban zone.

Telemedicine as an Access Strategy

Telemedicine is the use of information and communications technology to deliver clinical services across geographic distance. It has been increasingly deployed in low-resource and remote settings to extend specialist reach, support local health workers, enable remote diagnostic assistance, and reduce unnecessary referrals [4, 5]. In Latin American and Caribbean contexts, telemedicine programs have demonstrated capacity to improve maternal and neonatal outcomes, increase management of chronic non-communicable diseases at primary level, and reduce emergency evacuation rates in geographically isolated settings [6, 7].

Guyana's national hinterland telemedicine program deployed digital health kits that include Basic, Advanced, and Connectivity Only configurations at health posts, health centers, and district hospitals across the hinterland. These kits enabled synchronous video consultation between peripheral health workers and Georgetown-based specialists, facilitated remote ultrasound examination using point-of-care devices, and provided platforms for case documentation and referral tracking. The program expanded from a pilot of 4 communities in October 2022 to a network of 130 communities by 2026 [1].

Study Objectives

Despite the program's rapid scale-up, peer-reviewed descriptive analysis of its utilization patterns, service intensity trends, and system-level effects on referral burden remained limited. This study analyzed annual program data and site-level records from 2022 to 2026 to:

1. Characterize the scale and intensity of telemedicine service delivery;
2. Assess trends in clinical acuity and diagnostic reach; and;
3. Examine system-level indicators including hospital referrals eliminated and medical evacuations.

The primary research hypothesis was:

1. H₁: Expansion of telemedicine in Guyana's hinterland between 2022 and 2026 was associated with increased healthcare access and measurable reduction in hospital referral burden, as evidenced by growth in patient visits per community, serious case management, and referrals eliminated per call.

Methods

Study Design

This was a retrospective descriptive study analyzing annual program summary data and site-level operational records covering program inception in October 2022 through December 2026. Full annual data were available for 2022 through 2025; 2026 figures are projections based on January 2026 actuals. Because the analysis used programmatic administrative data without a concurrent comparison group, findings are interpreted as descriptive program evidence rather than causal impact estimates.

Data Sources

Data were extracted from the National Telemedicine Program Dashboard containing:

1. An Overview sheet with annual program-level indicators;

2. A Detailed Overview sheet providing site-level data including region, location, coordinates, installation date, population, kit type, facility level, annual call and visit counts, estimated travel cost to hospital, average travel time, and working days lost to travel;
3. Year-specific Usage sheets (2022–2026) with device-level performance data including sessions, calls, encounters, and sensor utilization; and;
4. A Calls to Date sheet with individual call-level records. Site-level 2025 data were used for facility-level analysis given data completeness.

Variables and Derived Indicators

Primary indicators extracted from the Overview sheet included: total communities served, new communities installed, telemedicine calls, patient visits, critical care encounters, medical evacuations, serious cases, remote ultrasound patients, and hospital referrals eliminated. Derived service intensity indicators computed for each year included: calls per community, visits per community, visits per call, serious cases per call, evacuations per call, and referrals eliminated per call where data were available. Travel time to hospital (hours) and travel cost (GYD) were used as contextual variables in site-level interpretation.

Data Analysis

All analyses were descriptive. Annual indicator trends were examined across five years and presented in tabular and ratio form. Derived intensity ratios assessed whether utilization deepened within communities as the network expanded. Site-level 2025 data were reviewed to characterize utilization

heterogeneity across facilities and explore the relationship between utilization volume and travel burden. Where 2026 values were projections, this was noted explicitly. Indicators reported as ‘no data’ were treated as missing rather than zero. No inferential statistics were applied, as this was a complete census of program administrative records.

Ethical Considerations

This study analyzed de-identified aggregate administrative program data maintained by the National Telemedicine Program. No individual patient identifiers were accessed or reported. Secondary analysis of operational records for quality improvement and research was conducted in accordance with Texila American University research ethics guidelines. No direct patient contact or primary data collection was conducted.

Results

Program Expansion and Network Growth

The telemedicine program expanded from 4 communities at inception in October 2022 to 26 in 2023, 63 in 2024, 85 in 2025, and 130 in 2026. A 32-fold increase in network coverage over four years (Table 1). New site installations were highest in 2024 (37 new sites) and 2026 (45 new sites). By 2026, the network spanned Regions 1, 4, 5, 6, 7, 8, 9, and 10, with deepest coverage in Regions 1, 7, 8, and which are the most geographically remote hinterland areas. Estimated hospital travel costs at installed sites ranged from GY\$6,000 to GY\$200,000, and average travel times ranged from 2 to 336 hours, confirming that the program reached communities with extreme geographic isolation.

Table 1. Annual Telemedicine Program Indicators, Guyana Hinterland, 2022–2026

Year	Communities	New Sites	Calls	Visits	Critical Care	Evacuations	Serious Cases	Ultrasound	Referrals Elim.
2022	4	4	55	84	No data	No data	11	No data	No data

2023	26	22	443	2,572	No data	65	226	No data	No data
2024	63	37	658	8,993	56	37	273	106	423
2025	85	22	1,293	~15,000*	82	38	501	383	445
2026	130	45	~2,500†	~25,000†	~200†	~67†	~850†	~800†	~1,900†
Total	130	130	~4,949	~51,649	–	~207	~1,861	–	–

*Estimate due to data capture interruption during technology transition in early 2025. †Projected from January 2026 figures.

Service Volume and Utilization Trends

Total telemedicine calls increased 45-fold over the study period: from 55 in 2022 to 443 in 2023, 658 in 2024, 1,293 in 2025, and approximately 2,500 in 2026. Patient visits grew even more sharply 298 fold from 84 in 2022 to approximately 25,000 in 2026. The ratio of visits to calls increased from 1.53 in

2022 to 13.67 in 2024 (Table 2), indicating that each telemedicine contact supported a substantially larger number of patient encounters as the program matured. Patient visits per community rose from 21.0 in 2022 to 192.3 in 2026, demonstrating deepening service intensity beyond mere geographic expansion. Calls per community increased from 13.75 to 19.23 over the same period.

Table 2. Derived Service Intensity Indicators, Guyana Hinterland Telemedicine Program, 2022–2026

Year	Calls per Community	Visits per Community	Visits per Call	Serious Cases per Call	Evacuations per Call	Referrals Elim. per Call
2022	13.75	21.00	1.53	0.20	No data	No data
2023	17.04	98.92	5.81	0.51	0.15	No data
2024	10.44	142.75	13.67	0.41	0.06	0.64
2025	15.21	176.47	11.60	0.39	0.03	0.34
2026	19.23	192.31	10.00	0.34	0.03	0.76

Clinical Acuity and Diagnostic Reach

The program’s clinical profile became more complex over time. Serious cases managed through telemedicine increased from 11 in 2022 to 226 in 2023, 273 in 2024, 501 in 2025, and approximately 850 in 2026. The serious cases per call ratio declined from 0.51 in 2023 to 0.34 in 2026, reflecting that volume growth increasingly incorporated lower-acuity contacts alongside complex case management consistent with a maturing primary care function rather than exclusive emergency use. Critical care encounters numbered 56 in 2024, 82 in 2025, and approximately 200 in 2026, indicating progressive use of the platform for the most clinically urgent presentations. Remote ultrasound grew from 106 examinations in 2024

to 383 in 2025 and approximately 800 in 2026, representing a qualitative expansion in diagnostic scope at the community level with particular significance for maternal and obstetric care.

System-Level Effects: Referrals Eliminated and Evacuations

Hospital referrals eliminated totaled 423 in 2024, 445 in 2025, and approximately 1,900 in 2026. The referrals eliminated per call ratio was 0.64 in 2024 and recovered to 0.76 in 2026, suggesting that approximately three in four telemedicine calls in 2026 were associated with a hospital visit avoided. Medical evacuations remained comparatively low and stable: 65 in 2023, 37 in 2024, 38 in 2025, and approximately 67 in 2026. Evacuations per call

decreased from 0.15 in 2023 to 0.03 in both 2025 and 2026, indicating that the proportion of telemedicine contacts requiring emergency physical transfer decreased as the program matured.

Site-Level Heterogeneity

Site-level analysis of 2025 data revealed substantial variation across communities (Table 3). The highest-volume facilities included R7 Paruima (906 patient visits, 73 calls), R7 Phillipai (669 visits, 57 calls), R7 Arau (644 visits, 70 calls), and R1 Santa Cruz (459 visits,

140 calls). Notably, travel time to hospital did not show a straightforward linear relationship with utilization [15-17]: R10 Hururu, with a 24-hour travel time, recorded 775 visits, while several sites with similar or longer travel times recorded minimal activity. This suggests that local implementation factors, including health worker engagement, training quality, community trust, kit functionality, and connectivity reliability—were significant mediators of utilization beyond geography alone.

Table 3. Top Facilities by Patient Visits, Guyana Hinterland Telemedicine Program, 2025

Facility	Region	Visits 2025	Calls 2025	Travel Time (h)	Travel Cost (GYD)	Kit Type
R7 Paruima	7	906	73	24	110,000	Advanced
R10 Hururu	10	775	29	24	15,000	Basic
R7 Phillipai	7	669	57	30	81,000	Advanced
R7 Arau	7	644	47	N/A	N/A	Advanced
R1 Santa Cruz	1	459	140	N/A	N/A	Advanced
R8 Paramakatoi	8	380	45	N/A	N/A	Advanced
R5 Moraikobai	5	198	18	4	N/A	Basic
R9 Fairview	9	189	87	48	16,000	Basic
R7 Waramadong	7	197	54	N/A	N/A	Advanced
R9 Shulinab	9	317	74	N/A	N/A	Advanced

Discussion

Telemedicine as a Bridge to Care

The findings demonstrate that Guyana's hinterland telemedicine program achieved meaningful expansion in both geographic coverage and actual service use between 2022 and 2026. The dramatic increase in visits per community from 21.0 to 192.3 confirms that the program became progressively embedded in routine clinical practice rather than remaining episodic or emergency only [4, 5]. For communities where hospital access requires days of travel at costs representing a significant share of household income, this embedding into routine care represents a qualitative

transformation in locally available health services. This finding is consistent with telemedicine effectiveness evidence from Brazil's Rede Universitária de Telemedicina, which demonstrated reduced emergency transfers in the Amazon region, and from Canada's northern telehealth networks showing sustained chronic disease care continuity for indigenous communities [11, 12].

Clinical Scope and Referral Burden

Growth in serious cases, critical care encounters, and remote ultrasound indicates that the program extended its clinical scope beyond low-acuity consultations [6]. The declining serious case per call ratio from 0.51

in 2023 to 0.34 in 2026 correctly reflects program maturation. A larger proportion of contacts represented routine primary care (antenatal follow-up, chronic disease monitoring) alongside complex case management, which is the expected pattern of a maturing service [8]. The approximately 1,900 hospital referrals eliminated in 2026, with a referrals-eliminated-per-call ratio of 0.76, indicates that telemedicine was associated with a hospital visit avoided in approximately three of four clinical contacts. A finding consistent with the telemedicine effectiveness literature from comparable remote settings [6, 7]. Stable evacuation rates despite tenfold volume growth further support the interpretation that telemedicine enabled earlier recognition and local stabilization, reducing the proportion of cases progressing to emergency transfer [4, 5].

Implementation Quality and Site-Level Variation

Substantial site-level heterogeneity confirms that geography creates the need for telemedicine but does not determine utilization [10]. Local implementation factors such as health worker engagement and confidence, connectivity reliability, equipment uptime, community trust, and integration into daily clinical workflows appear to be proximal determinants of uptake. This finding aligns with implementation science literature emphasizing that fidelity to implementation protocols, local adaptation, and staff training quality are stronger predictors of service uptake than structural availability alone [10]. High-utilization sites provide a natural model for identifying and systematically supporting implementation practices across the network.

Limitations

This study has six limitations. First, it is a retrospective descriptive analysis without a concurrent control group, limiting causal attribution. Second, 2026 data are projections from January figures. Third, 2025 patient visit

data are estimates due to a technology transition data capture gap. Fourth, operational definitions of ‘serious cases’ and ‘hospital referrals eliminated’ are not formally specified and may vary across sites and time. Fifth, no patient-level clinical outcomes or diagnoses are available, preventing assessment of clinical effectiveness. Sixth, site-level travel-burden correlations were exploratory without confounding adjustment. These limitations mean findings should be read as strong descriptive program evidence rather than definitive proof of causal impact.

Public Health and Policy Implications

The data support sustained investment in Guyana’s hinterland telemedicine program. With 130 communities served by 2026 and evidence of deepening clinical utility and referral burden reduction, the program has demonstrated proof of concept at national scale. The next phase should focus not only on further network expansion but on improving quality, reliability, and clinical depth at existing sites: investing in connectivity uptime through satellite and solar-powered backup systems, ensuring equipment maintenance contracts with service-level agreements, and providing ongoing health worker training in telemedicine-supported clinical protocols [2, 9].

The finding that implementation quality mediates utilization beyond geography creates both a challenge and an opportunity. A structured implementation support program including site visits, peer learning between high and low performing communities, health worker coaching, and community engagement could improve utilization at underperforming sites without additional capital investment [10]. The program’s utilization records provide the foundation for a monitoring dashboard enabling the Ministry of Health to identify priority support sites on an ongoing basis.

Telemedicine must be understood as a component of not a substitute for the broader Universal Health Coverage strategy. It

addresses the distance barrier to specialist consultation and diagnostic support but does not resolve deficits in physical infrastructure readiness, essential medicine supply, health worker distribution, or referral transport [3, 13]. Effective integration within the UHC agenda requires linkage with primary health care strengthening, reliable supply chain, culturally safe care practices for indigenous communities, and a functional referral and transport system that can act on the clinical decisions telemedicine enables [13, 14].

Conclusion

Guyana's hinterland telemedicine program achieved substantial growth in geographic coverage and clinical service delivery between 2022 and 2026. Growth in visits per community, serious case management, remote ultrasound use, and hospital referrals eliminated alongside stable medical evacuation rates despite rapidly expanding clinical volume is consistent with improved healthcare access, local management of complex clinical presentations, and referral burden reduction for some of the most geographically isolated communities in the region [18]. These findings suggest that access in remote settings depends not only on geography and transport barriers, but also on service delivery capacity and the availability of appropriately skilled personnel [19]. Site-level heterogeneity confirms that implementation quality and local integration are key determinants of actual utilization beyond geography alone [20]. Future research should evaluate patient level outcomes, referral appropriateness, timeliness, household cost savings, and health worker experience. Investment in implementation quality, connectivity reliability, and integration with the UHC agenda will be essential to ensure geographic reach translates into equitable, effective care for all hinterland communities.

Conflict of Interest

The authors declare no conflict of interest.

Ethical Approval

This study analyzed de-identified aggregate administrative program data maintained by the Ministry of Health of Guyana's national telemedicine program. No individual patient identifiers were accessed. Secondary analysis of operational records for research and quality improvement was conducted in accordance with Texila American University research ethics guidelines. No direct patient contact or primary data collection was involved.

Author Contributions

Aruna Faria: Conceptualization, data curation, formal analysis, writing original draft, writing review and editing.

Abiodun Olaiya Paul: Supervision, methodology, writing review and editing.

Data Availability

The data supporting this study are derived from the national telemedicine program operational dashboard maintained by the Ministry of Health of Guyana. Aggregate de-identified program data are available from the corresponding author upon reasonable request and subject to Ministry of Health approval.

Funding

This study received no external funding. The research was conducted as part of doctoral degree requirements at Texila American University, Guyana.

Acknowledgements

The authors acknowledge the Ministry of Health of Guyana and the national telemedicine program team for expanding healthcare access in the hinterland, and the health workers and communities who have embraced the telemedicine service.

References

- [1]. Ministry of Health, Guyana, 2026, Guyana telemedicine program: Annual performance data 2022–2026. Ministry of Health, Georgetown, Guyana.
- [2]. Pan American Health Organization (PAHO), 2019, Health in the Americas: Guyana country profile. PAHO/WHO Regional Office for the Americas, Washington, DC, <https://www.paho.org/en/countries/guyana>
- [3]. Government of Guyana, 2022, National health sector development plan. Ministry of Health, Georgetown, Guyana.
- [4]. Kruse, C. S., Karem, P., Shifflett, K., Vegi, L., Ravi, K., Brooks, M., 2016, Evaluating barriers to adopting telemedicine worldwide: A systematic review. *Journal of Telemedicine and Telecare*, 24(1), 4–12, <https://doi.org/10.1177/1357633X16674087>
- [5]. Wootton, R., 2012, Twenty years of telemedicine in chronic disease management: An evidence synthesis. *Journal of Telemedicine and Telecare*, 18(4), 211–220, <https://doi.org/10.1258/jtt.2012.120219>
- [6]. Scott Kruse, C., Karem, P., Shifflett, K., Vegi, L., Ravi, K., Brooks, M., 2022, Telemedicine effectiveness during COVID-19 and beyond: A systematic review. *Journal of Medical Internet Research*, 24(8), e38643, <https://doi.org/10.2196/38643>
- [7]. Orlando, J. F., Beard, M., Kumar, S., 2020, Systematic review of patient and caregivers' satisfaction with telehealth videoconferencing as a mode of service delivery in managing patients' health. *PLOS ONE*, 14(8), e0221848, <https://doi.org/10.1371/journal.pone.0221848>
- [8]. Iyengar, P., Mabvukure, B., Yadav, P., Adams, J., 2021, Strengthening last-mile supply chains in low-density settings: Lessons for resilience. *Global Health: Science and Practice*, 9(Suppl 2), S272–S285, <https://doi.org/10.9745/GHSP-D-21-00008>
- [9]. Watkins, K., Bertone, M. P., Witter, S., 2022, Health infrastructure maintenance and uptime: Evidence and frameworks. *Health Policy and Planning*, 37(6), 738–748, <https://doi.org/10.1093/heapol/czac016>
- [10]. Gilmore, B., McAuliffe, E., Power, J., Vallières, F., 2021, Data analysis and synthesis within a realist evaluation: Toward more transparent methodological approaches. *International Journal of Qualitative Methods*, 18, 1–10, <https://doi.org/10.1177/1609406919859754>
- [11]. Alkmim, M. B., Figueira, R. M., Marcolino, M. S., Cardoso, C. S., de Abreu, M. P., Cunha, L. R., Antunes, A. P., Resende, A. G., Resende, E. S., Ribeiro, A. L., 2012, Improving patient access to specialized health care: The Telehealth Network of Minas Gerais, Brazil. *Bulletin of the World Health Organization*, 90(5), 373–378, <https://doi.org/10.2471/BLT.11.099408>
- [12]. Marchildon, G. P., 2020, Canada's Medicare and health system resilience: Lessons from rural and remote care. *Healthcare Papers*, 19(3), 8–19, <https://doi.org/10.12927/hcpap.2020.26273>
- [13]. World Health Organization and World Bank, 2023, Tracking universal health coverage: 2023 global monitoring report. WHO, Geneva, <https://www.who.int/publications/i/item/9789240080379>
- [14]. Kruk, M. E., Gage, A. D., Arsenault, C., Jordan, K., Leslie, H. H., Roder-DeWan, S., et al., 2018, High-quality health systems in the Sustainable Development Goals era: Time for a revolution. *The Lancet Global Health*, 6(11), e1196–e1252, [https://doi.org/10.1016/S2214-109X\(18\)30386-3](https://doi.org/10.1016/S2214-109X(18)30386-3)
- [15]. Weiss, D. J., Nelson, A., Vargas-Ruiz, C. A., Gligorić, K., Bavadekar, S., Gabchenko, E., et al., 2020, Global maps of travel time to healthcare facilities. *Nature Medicine*, 26(12), 1835–1838, <https://doi.org/10.1038/s41591-020-1059-1>
- [16]. Arsenault, C., Jordan, K., Lee, D., Dinsa, G., Manzi, F., Marchant, T., Kruk, M. E., 2020, Equity in primary care access in the global south: Cross-sectional analysis. *PLoS Medicine*, 17(6), e1003125, <https://doi.org/10.1371/journal.pmed.1003125>
- [17]. Ouma, P. O., Maina, J., Thurairana, P. N., Macharia, P. M., Alegana, V. A., English, M., Okiro, E. A., Snow, R. W., 2018, Access to emergency hospital care provided by the public sector as a function of travel time in sub-Saharan Africa. *The Lancet Global Health*, 6(3), e342–e350, [https://doi.org/10.1016/S2214-109X\(18\)30069-X](https://doi.org/10.1016/S2214-109X(18)30069-X)

[18]. Hone, T., Rasella, D., Barreto, M. L., Atun, R., Majeed, A., Millett, C., 2017, Large reductions in amenable mortality associated with Brazil's primary care expansion and strong health governance. *Health Affairs*, 36(1), 149–158, <https://doi.org/10.1377/hlthaff.2016.0966>

[19]. Schneider, H., Blaauw, D., Gilson, L., Chabikuli, N., Goudge, J., 2021, Health systems and access to antiretroviral drugs for HIV in Southern

Africa: Service delivery and human resource challenges. *Reproductive Health Matters*, 14(27), 12–23, [https://doi.org/10.1016/S0968-8080\(06\)27232-X](https://doi.org/10.1016/S0968-8080(06)27232-X)

[20]. Dolea, C., Stormont, L., Braichet, J. M., 2010, Evaluated strategies to increase attraction and retention of health workers in remote and rural areas. *Bulletin of the World Health Organization*, 88(5), 379–385, <https://doi.org/10.2471/BLT.09.070607>