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Editorial Board

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Contents

Face the Challenges and Justify Yourself!

Each and every field of medicine is advancing in an astonishing pace with newer understanding, novel interventions, renewed standards, amazing innovations, so on, and so forth. This is because of the tireless work of people all over the world. India is enthusiastically taking part in this process. We have reached the moon and heading to the sun. In no time, we contained COVID-19 and came out with a vaccine. These achievements happened not as an overnight magic but because of years of hard work. The achievements of yesteryears should not make one lazy. As it is always quoted "miles to go before we sleep," we have to work hard and hard to make humanity better.

In this context, one has to give more emphasis on "research." For research to occur, one should have the right questions to ask. The ability to ask appropriate questions depends on the critical understanding of the current situation in question. When we analyze the current scenario in any field, you may find some gaps to be filled. If you could understand the "gaps," you are in the right track of research. Once you are in track, the other important task is to get an answer. For an answer, one has to work hard and harder. If the aim is lofty, the harder is the work. The endurance and perseverance are mandatory for success. It is only through focused and persistent work, the aim is achieved.

During this journey, there will be several setbacks and distractors. One has to overcome the setback with optimism. The distractors must be understood properly and avoided. Hence, the journey is not an easy job. The success of the journey depends on the endurance of the researcher. The potential of an individual is phenomenal. One has to tap this potential and channelize it to achieve the final result.

In the present era, there is a shortage of avenues to express one's own work. This is more so in the case of young researchers. What could be the remedy for this? The process to publish an article is elaborate and hence there may be a delay in the publication of research. The answer to overcome the waiting period may be shortening the time from submission to print without compromising the quality of the final product. Hence, we have decided to come out with a journal which caters young as well as with established researchers alike and helps them without much delay in publication.

As editorial policy, we are focusing the young researchers who are struggling to get an opportunity. They need encouragement. We believe the potential of young researchers is enormous. It is our responsibility to bring them to the forefront. Nobody knows who will be the next "Nobel Laureate." At the same time, we honor the wisdom of well-established researchers. They also have enough space to expose their research in the journal.

Hence, we are proud to announce the birth of the "Journal - *Journal of Advanced Health Research and Clinical Medicine*" from "Amala Institute of Medical Sciences." It is a multispecialty journal that intends to cater to researchers in all disciplines of medicine and allied specialties. We expect wholehearted patronage from everyone and hope you may consider it seriously for publication of your research. Through the journal, we intend to publish original research work, review articles, opinions, case reports, letter to editor, symposia, and book reviews to name a few. As the journal matures, we may add more and more features to make it more interesting to read.

The big question at this juncture is – "Why a new journal?" To answer this, one may have to assess the present scenario of publication. At present, there are only very few journals to help the researchers to publish their work, especially for the new researchers. Many a time, the article sent may be rejected. There are multiple reasons for this. It may be due to the inappropriateness of the article in that particular journal, or there may be some methodological issues, or the argument leading to the conclusion may not be convincing.

Through the journal, we aim to offer peer review of the work so that one will get more insight into the work, the correction of the lacunae of methodology, guide you through the discussion, and reach a meaningful conclusion. In the future, we plan to help you to write more effectively, if you desire so. Hence, over a period, the novice researcher becomes a very accomplished one. At the same time for a seasoned researcher, the journal provides a platform to publish their work without any delay and hence to stay ahead of time. The delay in publication leads to the loss of the relevance of the work and the entire effort is wasted. Since we offer an early and prompt peer review, the researcher may be assured their cherished work will be properly projected before the scientific community. Hence, we hope the journal will be a boon to both novices as well as seasoned researchers alike.

We are planning to publish the journal biannually. The success of the journal depends on the contribution from researchers like you. On behalf of the editorial team, I thank you in advance for your contribution. I hope you will help us to fulfill our aims in the years to come.

I may be failing in my duty if I do not appreciate the wholehearted enthusiasm of our Executive Editor, Dr. C. R. Saju and Deputy Editor, Dr. Ajith. T. A., without whom the journal would not have materialized. I also sincerely thank our director, Rev. Fr. Julious Arakkal CMI, for his never-ending enthusiasm and encouragement, which made the journal to take shape. I salute the entire management of Amala, editorial board members including the Medical College principal, Dr. Betsy, and the entire faculty for the help and guidance given at the time of crisis.

With these words, I sincerely and wholeheartedly present the journal before you and solicit your patronage in the years to come.

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Review Article

Macrophage Polarization: An Ideal Therapeutic Strategy Remains to be Explored in Atherosclerotic Cardiovascular Disease

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Abstract

The prevalence of atherosclerotic cardiovascular disease (CVD) is alarmingly increasing across the world. Despite a more detailed understanding of cardiac macrophage heterogeneity is lacking, their crucial role in the development and rupture of plaque is described as well. Furthermore, their functional plasticity has been involved in myocardial remodeling and scar formation in postinfarct tissue. Among the two types of macrophages that exists, classical M1 has a role in the incidence of coronary artery lesions, while alternate M2 types are involved in postinfarction tissue repair. Different cytokines and chemokines released from the pro-inflammatory M1 type macrophage augment plaque formation and rupture. More M1 macrophage accumulation was evident in the rupture-prone areas of the atherosclerotic plaque. M2 cells were found more in the stable regions of plaque, away from the lipid core and thus resist foam cell formation. Persistent inflammation is a hallmark of chronic heart failure. Different subtypes of M2 macrophages, such as M2a, M2b, M2c, and M2d, were described. M2b macrophages inhibit leukocyte infiltration and may have anti-atherosclerotic effects/protection of myocardial disease, among others. Various detection methods for the M1 and M2 polarization were described, which include identification of cell surface markers/secretary proteins using quantitative polymerase chain reaction (PCR), enzyme-linked immunosorbent assay (ELISA), Western blot, flow cytometric analysis, and immunohistochemistry. Considering their role in the maintenance of cell homeostasis, balanced polarization offers a new ideal target for therapeutic manipulation. This review article discusses an update on macrophage polarization in atherosclerotic CVD.

Keywords: Anti-inflammatory agents, atherosclerosis, coronary artery disease, cytokines, macrophages, myocardial reperfusion injury

Introduction

Acute myocardial infarction (AMI) and postinfarct complications due to cardiac remodeling/scar formation remain the major cause of morbidity and mortality.[1] Prevention of atherosclerotic cardiovascular disease (CVD), myocardial remodeling, and collagenous scar formation in postinfarct patients remain major challenges in interventional cardiology. Macrophages are a heterogeneous population of innate myeloid cells which are one of the most functionally diverse cells present in the hematopoietic system.[2] These large vacuolar cells are highly phagocytic and thus release various mediators to modulate the immune response. Their major physiological functions include the prevention of infection, tissue repair, and angiogenesis.[3] Macrophages resident in tissues are originating from progenitor cells of the yolk sac, while bone marrow hematopoietic stem cells provide the monocyte-derived macrophages.[4] Despite various physiologic roles, their imbalanced level in tissues is involved in pathologic processes such as altered tissue homeostasis, host defense, organ development, inflammation, and tissue remodeling.[5]

Knowledge on the macrophages, including their polarization processes in the pathophysiology of diseases, was studied during the last decade. Both *in vitro* and *in vivo* investigations were carried out on the polarization of macrophages associated

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with several human ailments. These diseases include cancer, pregnancy-associated pathology, microbial defense, obesity, atherosclerosis, autoimmunity, asthma and allergy, fibrosis, and wound healing.[6] The change in phenotype between M1 and M2 types has been described as macrophage heterogeneity. In atherosclerosis-associated CVD, the polarization concept of macrophage has been increasingly recognized. Previous studies demonstrated the involvement of pro-inflammatory M1 type macrophages increases the risk for atherosclerotic CVD associated with rheumatoid arthritis, antiphospholipid syndrome, systemic lupus erythematosus, and psoriasis.[7-9] Furthermore, cardiac macrophages play a significant role in the immune surveillance of myocardial tissue before and after MI. Considering the crucial role, interventions in macrophage polarization may provide a novel therapeutic opportunity to combat inflammation and, thus, the progression of atherosclerosis.[6] However, detailed studies mainly about the balanced polarization of macrophages in human coronary atherosclerotic disease are fragmentary. This review article discusses a recent update on the role of macrophage polarization in atherosclerotic CVD and macrophage-targeted therapy.

Polarization of Macrophages

The role of two main categories of immune cells, innate and cells of the adaptive immune system, has been described as well. Basophils, eosinophils, neutrophils, dendritic cells, mast cells, macrophages, and natural killer (NK) cells are the first cell lines in the innate immune system, which involve fast defense with limited specificity. T- and B-cells of the adaptive immune system show delayed activation with more specificity and are able to develop memory cells against pathogens. The main functions of macrophages include modulating the adaptive immune response against pathogens, induction and resolution of inflammation and tissue repair. Polarization, a plastic characteristic of macrophages, can be described as their conversion into functionally distinct types based on signals/stimuli received from their microenvironment.[10]

Polarization of naïve macrophage (M0) into classical M1 type and alternate M2 type has been described as well.[10] Macrophage polarization is crucial for tissue repair and maintenance of homeostasis.[11] Different inducers polarize M0 macrophages to M1 or M2 types. Functionally, M1 macrophages are pro-inflammatory and thus antimicrobial. While M2 is mainly anti-inflammatory and has M2a, M2b, M2c, and M2d subtypes.[12,13]

Activation and role of M1 and M2 types of macrophages are depicted in Figures 1 and 2. Among the subtypes of M2, M2b macrophages can interconvert to other subtypes in response to different stimuli.[14] Th1-derived cytokines (Interferon [INF]-gamma and tumor necrosis factor (TNF)-α) and lipopolysaccharide (LPS) in the microenvironment are able to polarize into M1 (pro-inflammatory) macrophages which further

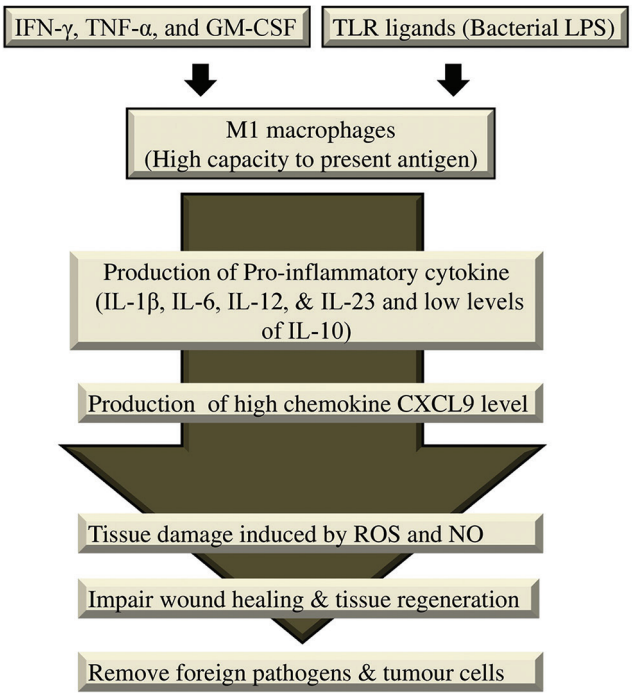

Figure 1: Various signals polarize M1 macrophage. Interferon-γ, tumor necrosis factor-α, granulocyte-macrophage colony-stimulating factor and toll-like receptor ligands (in presence of bacterial lipopolysaccharide) induce M1 macrophage formation. M1 has capacity to present antigen and release high level of pro-inflammatory cytokines such as interleukin-1 β, -6, -12, and -23 but low levels of IL-10. Among the chemokines secreted, chemokine motif ligand-9 is in high level. M1 macrophages induce tissue damage by reactive oxygen formation (ROS) and nitric oxide (NO) to remove foreign pathogens and tumour cells. Furthermore, ROS and NO impair tissue regeneration and wound healing. LPS: Lipopolysaccharides, IFN: Interferon, TNF: Tumor necrosis factor, GM-CSF: Granulocyte-macrophage colony-stimulating factor, TLR: Toll-like receptor, LPS: Lipopolysaccharide, C-X-C: Chemokines secreted, chemokine, CXCL-9: Chemokines secreted, chemokine ligand-9, ROS: Reactive oxygen formation, NO: Nitric oxide

secrete cytokines and chemokines. The pro-inflammatory cytokines secreted are interleukin (IL)-1 β, TNF-α, IL-6, IL-12, IL-18, IL-23, and type I Interferon (IFN).[15] The chemokines secreted are C-X-C motif chemokine ligand (CXCL) (CXCL-1,-3,-5,-8,-9,-10,-11,-13 and-16) and C-C motif chemokine ligands (CCL) (CCL-2,-3,-4,-5,-8,-11,-15,-19, and-20).[16,17] M1 supports the activation of T helper cells (Th)-1 and facilitates complement-mediated phagocytosis. Different subtypes of M2 (anti-inflammatory) macrophages such as M2a, activated by IL-4 or IL-13; M2b, activated by immune complexes and LPS; M2c, activated by glucocorticoids or IL-10 and M2d, activated by adenosine or IL-6.[18]

M1 exhibits potent microbicidal activity and promotes strong IL-12-mediated Th1 responses, while M2 supports Th2-associated effecter functions. Both macrophages are different in their cell surface markers and secreted cytokines. The biomarkers of M1 are a cluster of differentiation (CD)-80,

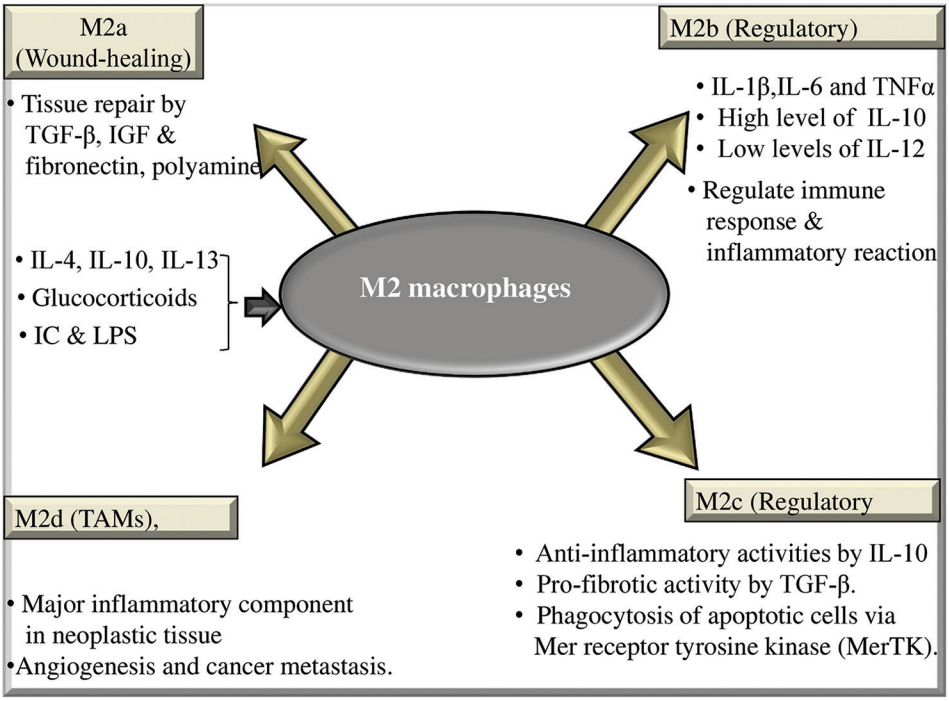

Figure 2: Various signals polarize M2 macrophages. The factors stimulate M2 polarization include interleukin-4, -10 and -13; glucocorticoids, lipopolysaccharides and immune complexes (IC). M2 macrophages exist in different subtypes and they are induced by different factors. IL-4 and IL-13 induce M2a subtype which is also called wound-healing macrophages. The secreted factors such as transforming growth factor-beta (TGF-β), insulin-like growth factor and fibronectin favors tissue repair. IC, toll-like receptor (TLR) and IL-1R induce M2b subtype and it secretes IL-1 β, IL-6, tumor necrosis factor α, high level of IL-10 and low level of IL-12. Its main functions are regulation of immune response and inflammation. IL-10 receptor via signal transducer and activator of transcription-3 activates M2c and releases more IL-10 and TGF-β. Thus, it exhibits anti-inflammatory and pro-fibrotic activity. M2c macrophages have high expression of Mer receptor tyrosine kinase and are effective in phagocytosis of apoptotic cells. TLR ligands and A2 adenosine receptor induce M2d macrophages (also known as tumor-associated macrophages). IL-6 or its agonists can also induce M2d. These cells secrete more IL-10, vascular endothelial growth factor for angiogenesis and metastasis. They are a major inflammatory component in tumor tissue. IL: Interleukin, IC: Immune complexes, TGF-β: Transforming growth factor-beta, IGF: Insulin-like growth factor, TLR: Toll-like receptor, TNF: Tumor necrosis factor, STAT-3: Signal transducer and activator of transcription-3, MerTK: Mer receptor tyrosine kinase, A2R: A2 adenosine receptor, TAMs: Tumor-associated macrophages

IL-6, inducible nitric oxide synthase (iNOS), TNF-α, CXCL-10, and CCL-2. M2-type macrophages are identified based on the expression of CD64 and CD209.[18] Detection of M2 macrophages also includes markers such as IL-10, arginase-1, and CD163.[18]

When the M1 phase continues, it can cause tissue damage mediated through the release of reactive oxygen species (ROS) and reactive nitrogen species. M2 macrophages secrete high amounts of IL-10 and transforming growth factor-beta (TGF-β) to suppress inflammation and contribute to tissue repair, remodeling, vasculogenesis, and retain homeostasis. Thus, M2 polarized macrophages play a role in the resolution of inflammation-mediated through their high endocytic clearance capacities and trophic factor synthesis, accompanied by reduced pro-inflammatory cytokine secretion.[19] During severe infection or inflammation, the M1 phenotype is the first exhibited macrophage, which releases enough IL-1 β,-12, and-23 and TNF-α in the affected organ.[20]

The metabolic process is also found to differ among the two types of macrophages. Enhanced unregulated metabolic pathways such as glycolysis, hexose monophosphate shunt, and decreased oxidative phosphorylation were found in the M1 type.[21,22] While in the M2 type, uncontrolled increases in oxidative phosphorylation and beta-oxidation pathways were reported.[23,24] Various methods for detecting the M1 and M2 polarization were described, which include identification of cell surface markers/secretary proteins using quantitative PCR (smaller number of cells), ELISA, Western blot, flow cytometric analysis (most reliable to detect cell surface markers and cytokines produced), microarray, and immunohistochemistry.[25] Thus, the detection of the surface markers present in biological fluids or in the tissue culture medium allows to differentiate of the phenotype of macrophages.

Macrophage Polarization in Atherosclerotic Cardiovascular Disease

Atherosclerosis has been described as a chronic inflammatory process initiated with endothelial dysfunctions where excess release of nitric oxide (NO) and ROS were evidenced.[26]

Macrophages are the major type of inflammatory cell that has a crucial role in myocardial ischemic injury with or without reperfusion. During embryonic development, the cardiac macrophages residing in adult heart were originated from erythromyeloid progenitors and fetal monocytes.[27] Human studies demonstrated an increased number of activated monocytes in the circulation of advanced heart failure (HF) patients.[28,29] According to Heidt *et al*., macrophages participate in the immunosurveillance of myocardial tissue and thus may be involved in the development of HF.[30] Despite the postinfarction inflammation in the myocardium, which is responsible for cardiac repair as well as scar formation, persistent inflammation is a hallmark of chronic HF.[31] Therefore, minimize the myocardial necrosis and reduce the scar formation are remaining important challenges toward the treatment of AMI. Unlike the neonatal myocardium, which did not recruit monocytes in significant numbers, the adult myocardium recruited significant numbers of monocytes during injury.[32] In postmyocardial infarction, the phosphatidyl serine receptors emerged as exclusive surface markers of resident/recruited macrophages.[33] The phosphatidyl serine receptor like T-cell immunoglobulin mucin protein 4 on macrophages is involved in the phagocytosis of apoptotic cells.[33]

The resident macrophage abundance within the infarct zone was markedly reduced in postinfarct, presumably through cell death from anoxia/nutrient deprivation but slowly increased through *in situ* proliferation. The resident cardiac macrophages accounted for only 2%–5% of the total cardiac macrophages within the infarct zone during the first few weeks of postinfarct. Their depletion impaired cardiac function and worsened infarct healing. An experimental study demonstrated that preventing monocyte influx has a beneficial protective effect from inflammation associated ischemic injury in adult mice.[34] More M1 macrophage accumulation was evident in the rupture-prone areas of the atherosclerotic plaque. M2 cells were found in the stable regions of plaque, away from the lipid core and thus resist the foam cell formation.[35,36] However, both types of cells were less associated with the fibrous layer of the atherosclerotic lesion.[37] Further evidence indicated that markers of M1 type (CD86 and iNOS) in unstable plaques increased while that of M2 type (Arg-1 and TGF-β) decreased in stable plaques.[38] Cholesterol crystals, oxidized low-density lipoprotein, LPS, pro-inflammatory cytokines released from Th1 cells can induce the polarization of the M1 type in atherosclerotic lesions.[33,39] Previous studies demonstrated a dynamic recruitment of monocytes to the myocardium after the AMI. This is mainly dependent on the mobilization of splenic monocytes and extramedullary splenic hematopoietic stem cells.[40-42]

Overabundance of inflammatory macrophages in the infarct compromises repair and promote HF and thus rendering these cells a potential drug target.[43] Macrophages in healthy myocardium are derived from local proliferation. The pro-inflammatory profile of M1 macrophages involves in plaque rupture lesions and thus has pro-atherogenic effects.[44,45] M1 produces more pro-inflammatory cytokines/chemokines that exacerbate cardiac injury. Cytokines/chemokines will activate myofibroblasts and promote their proliferation and recruitment of circulating fibrocytes. While M2c-type macrophages can inhibit the production of pro-inflammatory cytokines, NO and ROS and thus limit the progression of inflammation.[46]

Overexpressed cardiac monocyte chemoattractant protein-1 (MCP-1 or CCl2) was found to induce macrophage infiltration, accumulation of cardiac myofibroblasts, IL-6 secretion, and neovascularization.[47] All these effects were demonstrated to be effective in attenuating the remodeling of the myocardium and left ventricular (LV) dysfunction after MI in a murine model. The effect of IL-6 and MCP-1 in the cardiomyocyte is mediated through the signal transducer and activator of the transcription (STAT)-3 signal pathway, which finally differentiates cardiac fibroblasts into myofibroblasts.[47] This observation was further supported by the findings in MCP-1-/-mice that a decreased or delayed infiltration of macrophage made delay in the healing of infarct.[29] Among the M2 subtypes, the M2b macrophages inhibit leukocyte infiltration and thus may have anti-atherosclerotic effects as well as protection of myocardial disease.[48]

During the M2 polarization, arginases (arginase-1 and-2) compete with iNOS for arginine in macrophages and deplete its level.[49] The produced polyamines and proline involve in cell differentiation and collagen production respectively, to repair the extracellular matrix.[50] Experimental study in mice bone marrow-derived macrophages demonstrated that administration of M2b macrophages significantly attenuated myocardial injury.[48] The finding was supported by the evidence in mice administered with M2b macrophages that a significant decrease in serum cardiac troponin I level, apoptotic index, infarct area, and nuclear factor-κB (NF-κB) signaling activation after 2 h of reperfusion.[48] Cardiac fibrosis, followed by AMI, is a major risk factor for cardiomyopathy, LV remodeling and arrhythmia, hypertension, and HF.[51,52] Troidl *et al*., in an experimental MI mice model, demonstrated that during the early post-MI phase, called as inflammatory phase, classically activated M1 macrophages were predominant. In contrast, during later scar tissue formation, a transition from inflammatory to alternatively activated M2 macrophages was found.[53] M2d macrophages release IL-10 and vascular endothelial growth factors to promote angiogenesis.[54]

In addition to the M1 and M2 types, other types such as M4, M(Hb), Mox, and Mhem macrophages were also demonstrated in the atherosclerotic plaque.[55] M4 type is pro-inflammatory and pro-atherogenic which reduces phagocytosis to favors atherosclerosis.[56] They are induced by CXCl-4 chemokine and produce pro-inflammatory cytokines.[57] Mhem M(Hb) and Macs are anti-inflammatory as they release more IL-10 like M2 and prevent the progression of plaque.[58] The epigenetic modifiers such as DNA methylation (by DNA methyltransferase 3 alpha and DNA methyltransferase 1),

histone deacetylation (by histone deacetylase 3/9), and histone methylation (by lysine demethylase 4A) suppressed M2 type during inflammation.[59] Histone lactylation favors the polarization of more M2.[60] Therefore, reprogramming the transcriptional machinery by regulating the epigenetic modifiers may polarize M1 to M2 type and thus can be a potential target in preventing the progression of atherosclerosis.[60] However, cross-talk between intracellular signaling and associated regulation of transcription factors, the epigenetic regulation in favoring M2 polarization is limited to a great extend.[61] Nevertheless, the role of a balanced polarization of M1/M2 macrophage governs the fate of an organ during inflammation or injury. Indeed, novel agents that favor the polarization of M1 to M2 can reduce the non-resolving inflammation which proceeds to plaque rupture and postinfarct complications.

Molecules Regulating the Macrophage Polarization in Atherosclerotic Cardiovascular Disease

A detailed molecular mechanism of switching the M1 to M2 is not yet been elucidated completely. NF-kB, STAT-1 and-6, and IRF-4 and-5 are transcriptional regulators that are described in the macrophage polarization.[62] The cytokines and transcription factors such as NF-kB, STAT-1 and -5, CCAAT/enhancer binding protein-δ, and interferon regulatory factor (IRF)-3 and-5 were more expressed in M1-type macrophages [Figure 3]. Among these, NF-κB and STAT-1 are the two major key transcription factors involved in the polarization of M1 type.[10,12,63-66] Cytokines such as IL-4,-13,-10,-33, and TGF-β signals make M2 polarization.[66] IL-4 and IL-13 directly induce M2 and the STAT-6 signal pathway was finally involved in their activation. STAT-6, IRF4, Jumonji domain-containing protein-3 (a histone demethylase), c-MYC, GATA binding protein 3, and peroxisome proliferator-activated receptors (PPAR)-γ and-δ are the key transcription factors that regulate the M2 genes expression.[10,67,68] Early growth response protein-2 in macrophages was considered as the common transcription factor that may decrease or increase in expression during the downstream signaling from NF-κB/STAT-1 and STAT-6, respectively.[69] Major cytokines and their transcription factors involved in the macrophage polarization are depicted in Table 1.

Tontonoz and Spiegelman demonstrated that PPAR-γ is essential for the differentiation of alternatively activated M2 macrophages.[70] PPARγ/RXR heterodimer can activate the arginase I promoter in the M2 type.[71] Arginase was found essential for the formation of ornithine and thus synthesizes the polyamines, cell growth, and proliferating agents in macrophage M2.[72] Agents that can promote the phenotypic switch of macrophages from the M1 (pro-inflammatory) type to anti-inflammatory M2 type are found to be effective in cardiac repair.[73] Cheng *et al*. demonstrated that PPAR-α was also found to promote anti-inflammatory M2 macrophage polarization in humans and mice.[74,75] In a rat model of isoproterenol-induced myocardial fibrosis, N-propargyl caffeate amide could regulate macrophage polarization and suppress myocardial

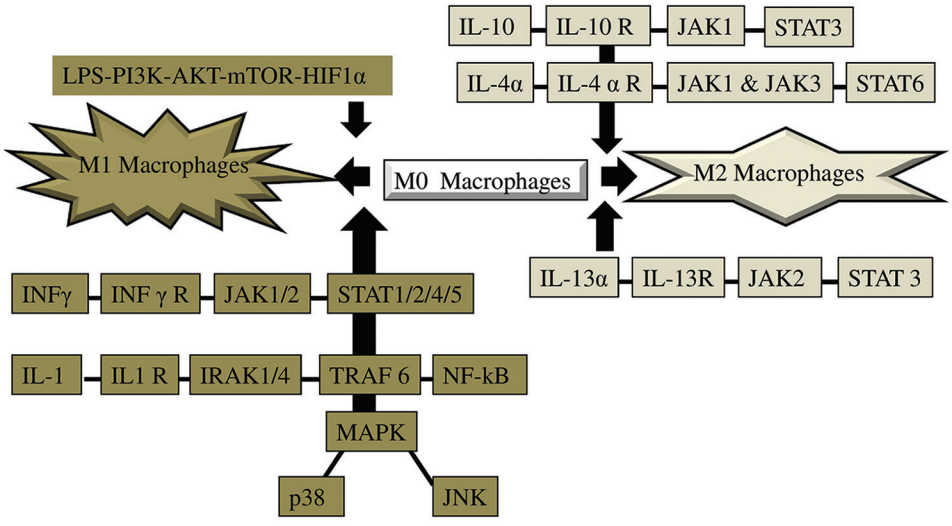

Figure 3: Multiple molecular mechanisms involved in the switching of Mo, naïve macrophage, to M1 and M2 types. Transcription factors such as nuclear factor-kappa B signal transducers and activators of transcription (STAT)-1 and-5, and interferon regulatory factor (IRF)-1 and 5 express more M1 type. Th2-associated cytokines interleukin (IL)-4 and IL-13 mediate downstream STAT-6 signal pathway in M2 macrophages. STAT-6 expresses early growth response protein 2 (EGR-2) which enhances the expression of transcription factors including peroxisome proliferator-activated receptors (PPAR)-γ and Myc. This induces the alterative polarization program. Other key transcription factors that regulate M2 polarization include IRF-4, Jumonji domain-containing protein-3 (a histone demethylase), and PPAR-γ and–δ. Bacterial lipopolysaccharides via the PI3K-AKT-mTOR-Hypoxia-inducible factor 1-alpha signaling induces M1 macrophage polarization. IRAK4: IL-1 receptor-associated kinase 4: JNK: Jun N-terminal kinase, IL: Interleukin, NF-kB: Nuclear factor-kappa B, STAT-1: Signal transducers and activators of transcription, IRF: Interferon regulatory factor, EGR-2: Early growth response protein 2, PPAR: Peroxisome proliferator-activated receptor, LPS: Lipopolysaccharides, HIF1α: Hypoxia-inducible factor 1-alpha

Table 1: Functions associated with cytokines and transcription factors in M1 and M2 type macrophages

Macrophage type	Major cytokines	Transcription factors
M1	IFN-γ, TNF-α, GM-CSF, IL-12	STAT-1/2/4/5, IRF 9
	IL-1	NF-kB, MAPK
M2		
M2a	IL-4 and IL-13	STAT-3/6, IRF4
M2b	IL-1	Smad 2/3/4 (for TGF-β)
M2c	IL-10, TGF-β	
M2d	IL-6	

IFN-γ: Interferon-gamma, TNF-α: Tumour necrosis factor alpha, GM-CSF: Granulocyte-macrophage colony-stimulating factor, IL: Interleukin, IRF: Interferon regulatory factor, MAPK: Mitogen-activated protein kinase, NF-kB: Nuclear factor kappa-light-chain-enhancer of activated B cells, STAT: Signal transducer and activator of transcription 1, TGF-β: Transforming growth factor-β

fibrosis. Activation of the PPAR-γ pathway was the main mechanism behind the polarization toward the pro-resolving M2 phenotype.[76] When the STAT6/PPAR-δ signaling pathway is blocked, the M2-type polarization is found to be reduced.[77] DNA methyltransferase 1 target the gene silencing of the promoter of PPAR-γ in the M1 type was demonstrated in experimental atherosclerosis.[78,79] While in IFN-γ induced M1 polarization, an increased histone H4 acetylation at the TNF-α promoter in the ERK and p38 mitogen-activated protein kinase signaling pathways was observed.[80]

Previous experimental studies found synthetic and natural agents are effective to curtail inflammation and macrophage polarization. Bouhlel *et al*. demonstrated that rosiglitazone can activate PPAR-γ and induce human monocytes into M2 macrophages and thus favor the anti-inflammatory phenotype expression.[81] The effect was initiated with the IL-4-dependent signaling mechanism. Resveratrol regulated Janus kinase 2-signal transducer and activator of transcription pathway to polarize the anti-inflammatory M2 type after MI and could improve cardiac function in mice.[82] Furthermore, resveratrol can decrease the collagen–I and-III, and fibronectin in the extracellular matrix to ameliorate cardiac fibrosis. Metformin, antidiabetic drug, was an effective promoter of M2 type, which is mediated through AMP-activated protein kinase and thus able to prevent the progression of atherosclerosis.[83]

Micro RNA let-7c was demonstrated as a suppresser of M1 but enhancer of M2 polarization.[84,85] The mechanism was found to be mediated through interaction with nuclear targets and regulate the IL-4 and TLR4 signaling. Omega-3 fatty acids are well known for their anti-inflammatory activity by inhibiting the NLR family pyrin domain containing 3 inflammasome, which is mediated through PPAR-γ and enhancing G-protein coupled receptor 120/40 signaling.[86,87] Docosahexaenoic acid (DHA) has action on macrophages, mainly decreasing the secretion of IL-1 β, TNF-α, and IL-6, and blunt the M1 macrophage polarization upon LPS stimulation. Furthermore, M2 polarization was promoted in macrophage cell lines and primary mouse macrophages.[88,89] The anti-inflammatory effect was mediated through transcriptional activation of PPAR-α/γ, down regulation of NF-κB, and inhibition of an inflammasome, nucleotide-binding oligomerization domain-like receptor pyrin domain containing 3 activation. Furthermore, they are effective to regulate the pro-fibrotic pathway by decreasing the nuclear translocation of smad 2/3 and thus prevent the activation of TGF-β 1 downstream signaling.[86,90,91]

A study using macrophages isolated from murine bone barrow revealed that cholesterol-lowering agent simvastatin can convert M1 to M2 cells.[92] Atorvastatin is also effective in augmenting M2-type macrophage.[93] Thioredoxin was effective in differentiating M1 to M2 type macrophages and was found to be protective in CVD.[94] Several natural phytochemicals were demonstrated to be promoters of M2 macrophage polarization in experimental studies.[95,96] This includes many polyphenols, triterpenoids, flavonols, flavonoids, and alkaloids [Table 2]. Experimental study in apolipoprotein E deficient mice demonstrated that digitalis like cardiac glycoside, convallatoxin was effective to mediate PPARγ–induced expression of transmembrane receptors, integrins α_v and β5, which later heterodimerizes to polarize M2 type macrophages.[103] One of the active ingredients in Crocus sativus L., crocin, inhibited the nuclear translocation of NF-kB and favored M2-type polarization in coronary atherosclerosis in rats.[104] Ginsenoside Rb1, the main active principle of Panax Ginseng, increased the M2 macrophage phenotype and thus could stabilize the atherosclerotic plaque in the mouse model.[105] The mechanism was mediated through IL-4/IL-13 and STAT6 signaling. Despite the experimental studies, human studies on balancing macrophage polarization are fragmentary to explore the beneficial role in atherosclerosis.

Conclusion and Future Perspective

Plaque rupture in atherosclerosis and postinfarct complications due to cardiac remodeling/scar formation remains the major cause of morbidity and mortality.[1] Polarization of macrophages was defined as their differentiation into specific phenotypes with biological functions. Two classes of macrophages have been described, M1 and M2 types. The properties of M1 (pro-inflammatory) and M2 (anti-inflammatory) macrophages are similar to Th1/Th2 cells. M2 macrophages are further classified as M2a, M2b, M2c, and M2d, depending on their anti- or pro-inflammatory properties. Injury to the myocardium triggers an influx of monocyte which later differentiated into macrophages. Cardiac macrophages are implicated in heart tissue remodeling and repair. Polarization of macrophages has a significant influence on plaque outcome. Thus targeting the recruitment of monocytes or polarization of macrophages can be a potential therapeutic target. The beneficial effects of transcription factors PPAR-α and-γ and omega-3 fatty acids in cardiac energy metabolism and CVD were previously reviewed as well.[106,107] Therefore, PPAR-α and–γ may be ideal targets for therapeutic manipulation to prevent plaque rapture and to minimize secondary complications after MI.

Table 2: Agents promoting M2 macrophage polarization in various experimental models

Agent	Nature of the agent	Mechanism
Atherosclerosis experimental models		
Convallatoxin[103]	Natural cardiac glycoside	PPAR-γ
Rosiglitazone[81]	Synthetic	IL4 and PPAR-γ
N-propargyl caffeate amide[76]	Synthetic	PPAR-γ
Resveratrol[82]	Phenol and phytoalexin	JAK2-STAT3
Metformin[83]	Biguanide antidiabetic drug	AMPK
miRNA let-7c[84,85]	Micro RNA of the let-7 family	IL-4 and TLR-4
Thioredoxin[94]	Protein	PPAR-γ
Docosahexaenoic acid/cervonic acid[88,89]	Omega-3 fatty acid	PPAR-γ
Curcumin[97]	Polyphenol	PPAR-γ
Experimental inflammation models other than atherosclerosis		
Malibatol A[98]	Oligomer of resveratrol	PPAR-γ
Quercetin[99]	Flavonol	AMPK
Naringenin[100]	Flavonoid	NF-κB
Apigenin[101]	Flavonoid	PPAR-γ
Chrysin[102]	Flavonoid	PPAR-γ

AMPK: 5' adenosine monophosphate-activated protein kinase, PPAR-γ: Peroxisome proliferator-activated receptor-γ, JAK2: Janus kinase 2, STAT3: Signal transducer and activator of transcription 3, IL-4: Interleukin 4, TLR-4: Toll-like receptor 4

Despite various debates on the effective pharmacological doses, a recent meta-analysis concluded that supplementation of 0.8–1.2 g of omega-3 FA (Eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) for 12 months could reduce the risk of cardiovascular death and heart failure.[108,109] Accounting for the beneficial effects of omega-3 fatty acids supplementation in attenuating ROS, inflammation, and activation of NK cells activity in elder humans, a detailed future research is warranted to elucidate their effect on the macrophage polarization and beneficial outcome in subjects with post-MI.[110-112] For the *ex vivo* basic polarization studies, murine bone marrow-derived macrophages (contain more primary-derived cells) was found to be a better choice than the murine peritoneal macrophages, collected from the peritoneal exudates (contain more heterogeneous cell).[113] Nevertheless, the experimental study results on murine macrophages, the findings cannot be transferred to real human situations, which remains the major limitation. Shiratori *et al*. used human peripheral blood monocyte-derived macrophages, which can be a better choice to test the effect of various compounds on polarization in *in vitro*.[114] Previously, organic nanoparticles, including liposome and polymeric nanoparticle-based drug delivery were employed to various targets of atherosclerotic plaque.[115] Animal study demonstrated the macrophages-targeted drug delivery using liposome-containing monoclonal antibody tagged with the surface biomarkers of M1 (IL-6) and M2 (CD163) types as a promising approach.[116] However, such procedures are scant. Food and Drug Administration-approved biodegradable nanoparticles that possess low immunogenicity and cytotoxicity, such as polyglycolic acid, polylactic acid, and poly (lactic-co-glycolic acid) as carriers of drugs.[117] One such study using poly (lactic-co-glycolic-acid) bound pioglitazone in hyperlipidemic ApoE (-/-) mice demonstrated that pioglitazone could polarize M2 type macrophage and prevent atherosclerotic plaque rupture.[118,119] Thus nanoparticles in different charges, shapes, sizes, or surface-targeted proteins/ligands can be used to target the macrophages at the sub-endothelial lesion, which will be a future promise in this area of research. Approach using nanoparticles can also minimize the systemic adverse effect of many drugs. Despite various natural agents demonstrated to be effective on M2 polarization in experimental atherosclerotic models, they are highly inconsistent due to macrophage diversity and the more complex process of atherosclerosis in humans. The macrophage types and their distribution will vary based on the progression/stages of the disease, which will be a major challenge to be addressed in future studies. Hence, further studies in humans addressing the major obstacles like (1) Type of macrophage exists in different stages, age- and gender-wise progression of disease and (2) Effective delivery of nanoparticle-tagged agents to specific macrophage types without any adverse effect are inevitable.

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Conflicts of interest

There are no conflicts of interest.

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Original Article

Evaluation of Animal Birth Control Program in an Urban Area of North Kerala

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Abstract

Background: India contributes to 36% of global rabies-related deaths, according to the World Health Organization. To address the issue of increased number of stray dog exposures, the Kerala Government initiated a comprehensive plan that includes an intensive animal birth control (ABC) program along with antirabies vaccination. This study was conducted with the objective of evaluating the implementation of the ABC program in the corporation area of Kozhikode district. **Materials and Methods:** Evaluation of the ABC program was performed based on the Standard Operating Procedures proposed by the Animal Welfare Board of India. The program was evaluated using input–output analysis. **Results:** The input indicators included the infrastructure, workforce, equipment, and logistics for the conduct of the program. As per a survey conducted in Kozhikode Municipal Corporation in 2018, there were 13,182 ± 1612 stray dogs. The program includes sterilization and vaccination, as well as pet dog licensing and microchipping services. Even though a remarkable reduction in animal exposures is not seen in corporation area, not much cases of human rabies were reported. **Conclusion:** A single ABC clinic catering to a large population may not be enough to meet the increasing stray dog population. Achievements gained by the program may be diluted due to insufficient workforce and procedures. Sustained coverage of ABC programs to some extent can solve the frequent shortages of vaccines and hence the increased dependence on PEP which is overburdening the health system. The program may be expanded to rural areas also.

Keywords: Animal Birth Control Program, antirabies vaccination, evaluation, input–output analysis, Kozhikode Municipal Corporation, sterilization

Introduction

Rabies is a zoonotic disease primarily transmitted to humans through the bite of rabid animals. Worldwide, rabies is responsible for an estimated 59,000 deaths annually.[1] India contributes to 36% of global rabies deaths (World Health Organization).[2] According to the National Rabies Control Programme, India, suffers the greatest burden of rabies of any country in terms of annual human deaths and disability-adjusted life years.[3]

Evidence says that more than 95% of rabies is attributed to dogs.[4] Historically, mass culling of dogs has been used to control rabies in India. However, evidence shows that killing alone is ineffective at controlling stray dogs.[5,6] Instead, a balanced and optimal approach to the health of people, animals, and the environment is necessary, known as "One Health." This strategy encompasses collaboration with various sectors such as the environmental, veterinary, and public health fields along with community mobilization.[7]

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The Animal Welfare Board of India promotes the humane and effective population control of stray dogs through Animal Birth Control (ABC) programs.[8] Sterilization and immunization of stray dogs are implemented to prevent the spread of rabies, according to ABC Rules, 2001, as amended in 2010 and 2023.[9] The success of ABC program requires sterilizing 90% and vaccinating 70% of dogs.[10] Cities such as Chennai, Jaipur, Jodhpur, and Ooty and the entire states of Sikkim and Goa have achieved satisfactory results by intensively sterilizing and vaccinating street dogs under the ABC program.[11-14]

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In Kerala, the number of stray dogs and consequently the number of animal exposures have increased over the past few years. To address this issue, the Kerala Government initiated a comprehensive plan that includes an intensive ABC program to control the population of stray dogs. Pet owners are also required to obtain a mandatory license, and their animals must be vaccinated against rabies.[12]

The ABC program was launched in the Kozhikode Municipal Corporation on March 1, 2019. However, no evaluations have been conducted thus far to assess its effectiveness in controlling the stray dog population or human rabies. This study was conducted with the objective of evaluating the ABC program in the corporation area of Kozhikode district.

Materials and Methods

A cross-sectional study was conducted for the evaluation of the ABC Program (ABC) by input–output analysis method in Kozhikode Municipal Corporation over a period of 1 month from September 1 to September 30, 2022. Kozhikode district situated in the northern part of Kerala consists of one municipal corporation, seven municipalities, and 70 grama panchayats. The ABC program was implemented in urban areas of Kozhikode district in March 2019 and is functioning as per the ABC Rules 2001 (recent amendment in 2023).[15] It covers a geographical area of 118.59 km^2 and covers a total human population of 613,255 as per 2011 census data. The ABC hospital in the corporation conducts sterilization of stray dogs (castration for males and spaying for females) and antirabies vaccination subcutaneously or intramuscularly followed by ear notching (V-shaped cut in the ear) for identification.

An observation checklist based on the standard operating procedures of ABC program was used to assess the infrastructure, human resources, and funding of ABC hospital under input indicators. Records from ABC hospital were referred to obtain the number of stray dogs sterilized and vaccinated as process indicators. Data from the Anti-rabies Clinic at Govt Medical College Kozhikode regarding stray dog exposures and rabies deaths were referred to obtain the output indicators. Data from 2019 to 2022 were analyzed. Qualitative variables were expressed in percentages or proportions, and quantitative variables were expressed as mean and standard deviation.

Permissions were obtained from the Chief Veterinary Surgeon, Kozhikode Municipal Corporation and the Medical Officer incharge of Animal Bite Management Clinic, Government Medical College Kozhikode. Ethical clearance was not sought as it was a record-based study.

Results

The ABC program was initiated in Kozhikode Municipal Corporation in 2019. The program was evaluated using input–output analysis method.

Input indicators

The input indicators include the infrastructure, workforce, equipment, and logistics for the conduct of the program. There is one ABC hospital with the necessary drugs and equipment. Humane catching methods using butterfly-catching nets were used, and the dogs were transported in a global positioning system (GPS)-enabled caged vehicle. There are 19 kennels to accommodate nearly 60 dogs. The hospital has 13 staffs including three veterinary surgeons and five dog handlers. Capacity building of the staff was conducted through both induction and refresher trainings and also through various continued medical education (CMEs) and workshops for the medical officers. Dog handlers are well trained by World Wide Veterinary Service which is an Ooty-based nongovernmental organization. All the staff were vaccinated with antirabies pre-exposure prophylaxis and titer was checked regularly on a 6 monthly basis. A sum of 65–70 lakhs per annum is implemented under the plan fund of the Local Self Government Department. The availability of these resources has been shown as against the requirement as per the standard operating procedure (SOP) of the Animal Welfare Board [Table 1].

Table 1 shows the input indicators of the ABC program.

Process indicators

As per a survey conducted in Kozhikode Municipal Corporation in 2018, there were 13,182 ± 1612 stray dogs, equivalent to 21 dogs per 1000 population. It is estimated that the current number of stray dogs may have increased to approximately 26,000. The program includes sterilization and vaccination, as well as pet dog licensing and microchipping services provided by the institution. Five dog handles in the hospital catch four dogs each per day. So far, 9788 dogs have been sterilized (5094 spayed and 4694 castrated), and 10,341 dogs have been vaccinated. There has been an increase in the rate of sterilizations and dog vaccinations over the years [Figure 1]. In addition, 150 pet dogs have been microchipped to aid traceability. Microchipping is done at the nape of the neck. In 2018, a by-law was enacted to promote responsible pet ownership.

The institution carries out IEC activities – information education communication (IEC) to raise public awareness about the importance of stray dog sterilization, pet dog licensing, and first aid measures after animal exposure. The

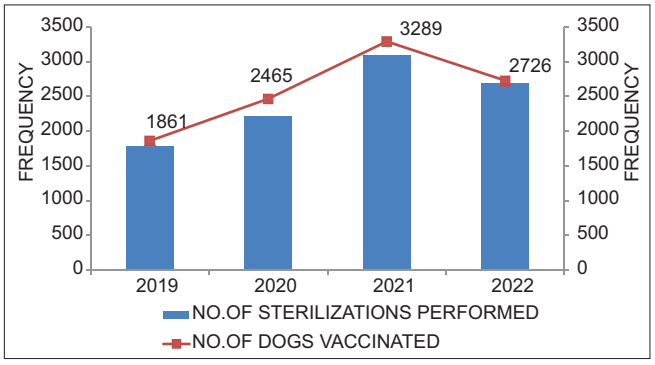

Figure 1: Process indicators of animal birth control program. A general increase in the rate of stray dog sterilizations and antirabies vaccinations was observed over the years from 2019 to 2022

Table 1: Input indicators of Animal Birth Control program

Resources	Recommendation as per SOP of Animal Welfare Board	Currently available in the ABC clinic
Infrastructure	ABC hospital with essential drugs and equipment to perform procedures	One ABC hospital
		Drugs and equipment supplied through Kerala Medical Service Corporation through tender or quotation
	Vehicle for transportation with adequate ventilation, fitted with grilled windows, and with no overcrowding	Caged vehicle of 3 feet height, width, and depth with GPS and camera tracking system dedicated to catching stray dogs
	60 open kennels of 3×4×6 feet dimension with proper lighting, cross ventilation, and open drains	19 kennels and a maximum of 5 dogs of a pack caught from the same area are kept in 1 kennel
	Separate kennels for aggressive/sick/rabid dogs	Kennels with a slope connected to the drain and proper lighting with ventilation
		Separate kennels for keeping ill or suspected rabid dogs
	Intersectoral coordination activities	Carried out with departments such as health, agriculture, and animal husbandry
Logistics	Dog-catching hoops with nets (butterfly-type net or Balinese pole net)	Humane catching methods using butterfly catching nets and release using a catchpole
	Dogs should be fed nutritionally twice a day ensuring proper storage, washing, and cooking hygiene	Adequate food and water and 12 h fasting before the procedure
	Procedure room with tables, suture materials, essential medicines, equipment, autoclave machine	Separate color codes for surgical equipment of male and female dogs. These are autoclaved and reused
		five tables in the operation theatre and 15–20 surgeries are performed in a day
	Adequate maintenance of cold chain for vaccines	Anti-rabies vaccines stored on a long-term basis in refrigerators maintaining cold chain
		Thermals with icepacks are used for day-to-day needs
	Record keeping	Registers needed for documenting surgery details, treatment, vaccination, catch and release details, maintaining stock and funds, etc., are well maintained in the institution
Human resource	Veterinary surgeon working for 40 h/week (1)	13 staff – veterinary surgeons (3) each working for 30 h/week
	Veterinary surgical assistant (1) caretakers or attenders for handling dogs (2)	Anesthetist (1)
		Dog handlers (5)
		Assistants (2)
		Sweeper (1)
		Van driver (1)
	Properly vaccinated staff with adequate antibody titer	All the staffs are vaccinated with anti-rabies pre-exposure prophylaxis and titer checked regularly on a 6-month basis
	Capacity building of medical officers and animal handlers	Capacity building of the staff conducted through both induction and refresher trainings and also through various CMEs and workshops for the medical officers. Dog handlers are well trained by WWVS which is an Ooty-based NGO
Funding		In the beginning, a sum of Rs. 1 crore was allotted from corporation plan fund for the infrastructure development of ABC hospital
		65–70 lakhs per annum from the ABC program plan fund of Local Self Government with Rs. 2100 per animal for the sterilization and vaccination of around 3000 animals per year

ABC: Animal birth control, WWVS: World Wide Veterinary Service, NGO: Nongovernmental organization, CMEs: Continued medical education, GPS: Global positioning system, SOP: Standard operating procedure

program has covered 75% of the surveyed stray dogs and 40% of the total stray dogs in the corporation area.

Figure 1 depicts the process indicators of the ABC program.

Output

Even though a remarkable reduction in animal exposures is not seen in corporation area, not many cases of human rabies were reported. Zero human rabies cases were reported for 3 consecutive years from 2018 to 2020. The COVID-19 pandemic and lockdown have brought a drastic decline in animal exposures and death due to rabies as well. However, a slight increase in exposures and rabies deaths are noted in 2021 and 2022.

Frequent audits are being conducted on a monthly basis for evaluation of the services provided. There is an ABC Monitoring Committee consisting of a corporation secretary, veterinary surgeon, health officer, and representatives from animal welfare organizations. Local fund audits are conducted annually to monitor the expenditure pattern.

Audits to evaluate the surgical procedures are also conducted often where the time is taken for the procedures, asepsis precautions followed, method of tackling complications if any, animal mortality, and postmortem analysis are all assessed. At the state level, there is a monitoring and implementation council for overall supervision.

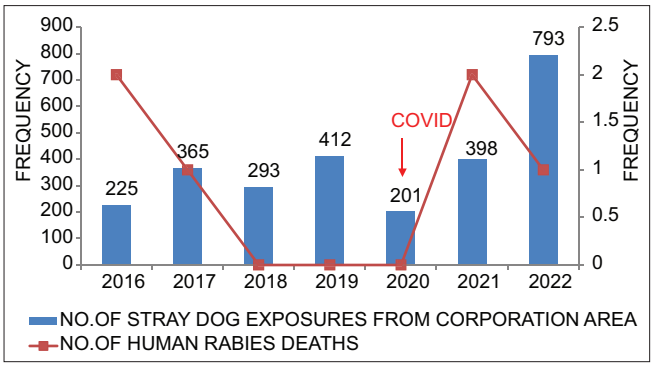

Figure 2: Output indicator of the animal birth control program. A remarkable reduction in animal exposures is not seen but not many cases of human rabies were reported. Zero human rabies cases were reported for 3 consecutive years from 2018 to 2020. The COVID-19 pandemic and lockdown have brought a drastic decline in animal exposures and death due to rabies as well. However, a slight increase in exposures and rabies deaths are noted in 2021 and 2022

The output of ABC program is shown in Figure 2.

Discussion

ABC program was implemented in Kozhikode Municipal Corporation in March 2019 with the establishment of a dedicated ABC hospital to provide services. Under the ABC program, dogs are humanely captured, medically sterilized, given rabies vaccinations, and then released back to where they had been caught after their recovery. The impact of the program on the control of human rabies is discussed under the following headings.

Impact on stray dog population

The survey in 2018 estimated the stray dog population to be 13,182 in the Kozhikode corporation area. This number has increased due to the COVID-19 pandemic in the intervening years. Hence, even though 80% of the surveyed dogs have been sterilized and vaccinated, there still remains a substantial population of strays to be covered under the program.[16] Data on the current number of stray dogs are lacking due to the paucity of surveys after 2018. Moreover, to witness a substantial reduction in the dog population, the program needs to sustain its targets for a more prolonged period.[17]

Cases of dog rabies are also an important indicator of the success of the program as can be seen in Chennai where a 50% reduction in rabies deaths among stray dogs were noted from 60 in 1997 to 30 in 2004, when the sterilization procedure was increased from 16,000 to 40,000.[14]

Unfortunately, even though laboratory confirmation of human rabies is carried out routinely for suspect rabies cases, the same cannot be said for dog rabies. As per centre for disease control and prevention (CDC) reports, the incidence of rabies among dogs is 0.3%.[4] However, the exact data regarding confirmed rabies cases in dogs are lacking as autopsy is not conducted for all the deaths in our setting.

Impact on the incidence of human rabies

The incidence of human rabies cases has been low during the study period with 0 rabies being reported for 3 consecutive years. The decrease in animal exposures during the COVID-19 pandemic and subsequent increase is an indirect indicator of the increase in stray dog population. Increased awareness among the population and high case fatality rate of rabies has resulted in an increase in the coverage of postexposure prophylaxis (PEP), which in turn has contributed to a reduction in rabies deaths.[18] The overreliance on PEP alone for the control of rabies may not be sustainable in the long run. Erratic supply also results in frequent shortage of antirabies vaccines and serum. Moreover, the high cost incurred by the government and public for the same may have a negative impact on the goal of 0 rabies deaths by 2030.

Evidence from Goa suggest that a multipronged strategy comprising sterilizing stray dogs, strengthening PEP coverage, creating community awareness, and enhancing human rabies surveillance activities was successful in reducing human rabies deaths from 17 in 2014 to 0 in 2018 and 2019.[11] A sustained program for more than a decade has caused a reduction in the incidence of rabies in Goa and Jaipur.[11,19]

Few reports of rabies death despite PEP have been documented, when rabies has occurred due to late initiation of PEP or due to direct inoculation to nerve endings in case of severe category 3 exposures.[1] This further goes to show that PEP alone may not be sufficient. Hence, a one health approach comprising interventions in animals and the environment in addition to PEP and an effective human rabies surveillance system is essential for the prevention and control of rabies.[20]

Impact on dog welfare

Pet dog licensing and microchipping were implemented in the study area to promote a responsible ownership and to aid traceability. One hundred and fifty pet dogs have been microchipped to aid traceability and a by-law was implemented for licensing pets. This was similar to the practice seen in some foreign countries such as Chile and Australia.[10,17] In Chile, a fine was imposed for owners whose pets are not identified and registered in the national database.

Chile also reported an increase in the registration of dogs from 2018 to 2021, even though the microchipping rate dropped drastically after 2018 during the COVID-19 pandemic. The rate of registration was also low due to the lack of enforcement of the law in communities.[10]

Few reports from Goa and Jaipur also mention the importance of implementing of microchipping. Findings from Vadodara show that microchips can be used to verify the vaccination and sterilization status of dogs and will help to generate more accurate vaccination and sterilization estimates for the private and street dog population.[21] Even though microchipping is a tedious process, such practices with strict enforcement of pet licensing laws can be incorporated into our setting too in a more extensive manner. This may reduce the abandonment of dogs by the owners.

Program challenges

A single ABC clinic catering to a large population may not be enough to adequately meet the increasing stray dog population. Achievements gained by the program may be diluted due to the lack of ABC program implementation by the vicinal local self-government institutions and insufficient workforce and procedures. It took more than a decade for Jaipur city to sterilize and vaccinate more than 80% of the 35,000 stray dogs and that too with three ABC hospitals. Rabies-free status was achieved only by the end of two decades.[13,19,22]

In Kerala, ABC program is mainly limited to urban areas only. A properly implemented system for sterilization and vaccination of stray dogs does not exist in rural areas.[23] The state of Goa achieved a rabies-free status only when the program was expanded to majority of the village panchayats and municipalities after a decade of multipronged strategies.[11]

In the present study setting, cats are responsible for around 60% of the animal exposures.[24] Even though more than 90% of rabies is dog mediated, cats are also a source of infection which is not addressed in the program. Addressing these challenges by a system focusing on one health approach is essential to achieving a rabies-free status.

Conclusion and Recommendations

A sustained ABC program and adequate PEP coverage along with the One Health Approach can have a significant impact on the elimination of rabies by 2030. Addressing gaps in the program such as annual surveying of stray dogs and confirmation of rabies deaths among dogs may be considered. Expanding the program to other local self-government bodies, especially in rural areas where human–animal interactions are more will further enhance the coverage. Other strategies that may be adopted include the promotion of responsible pet dog ownership, implementing a dog microchip registry, annual revaccination, shelter homes for stray dogs to prevent free roaming, and scientific waste management practices.

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Conflicts of interest

There are no conflicts of interest.

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Original Article

Resilience of the BUDS Community-based Rehabilitation Institutions during the COVID-19 Pandemic: Supporting Role of Local Governments

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Abstract

Background: BUDS (not an acronym) institutions are free and open special institutions established by Kudumbashree in Kerala for children from low-income households with intellectual or psychosocial impairments. We explored the impact of COVID-19 pandemic on BUDS beneficiaries and the organizational adaptation for continued operations during the period. **Methods:** We conducted telephonic in-depth interviews with eight BUDS teachers, three beneficiaries' parents, and two local government (LG) representatives. We did a deductive analysis to describe two major themes: one pertained to the physical, mental, and social challenges faced by beneficiaries and families of BUDS institutions and other on organizational adaptation to the situation in terms of sustaining classes for children and continued support for meeting basic needs. **Results:** Beneficiaries lost some therapeutic gains, while parents faced financial hardships. Trainers and LGs made active efforts for sustaining contact with children and parents, distribution of necessities for children, and home visits. Some trainers displayed an exemplary level of dedication. LGs facilitated service provision by continuing remuneration to trainers, and collaborating with various stakeholders like education and health, and initiating locally suitable measures. The Thenkoodu app for continued training was deemed not very useful by trainers and parents. **Conclusion:** Committed human resources, acceptance of ground realities, quick decision–making, and collaboration across stakeholders were important aspects of the response of LGs for continued service provision to BUDS beneficiaries during the COVID-19 pandemic. Our findings suggest that decentralized space where BUDS institutions emerged and expanded is beneficial for organizational resilience of community-based rehabilitation institutions.

Keywords: Community-based rehabilitation, decentralization, health lockdown, organizational adaptation, service delivery

Introduction

Globally, 2.4 million people are living with a condition requiring rehabilitation.[1] Disasters tend to highlight important inequities within society.[2] The COVID-19 pandemic and related control measures have drastically affected the daily lives of people[3] with long-term health-care needs, highlighting the need for improving rehabilitation services for people with disabilities (PWD).[4] Compared to the general population, the pandemic could have had a greater impact on PWD, significantly increasing their daily life challenges.[5] The International Classification of Functioning, Disability, and Health framework, a "biopsychosocial model" of disability[6] which measures disability and functioning at individual and population levels, conceptualizes[7] an individual's functioning as an interaction between their health conditions, environmental factors, and personal factors. In this context, a global pandemic causes myriad of challenges for PWD and existing systems for their treatment and rehabilitation. Repercussions of having a deficient health system might have a greater impact on PWD.[8] In addition to a higher risk of serious COVID-19, they might experience unique challenges

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associated with the social distancing measures.[4] Consequently, the World Health Organization (WHO)[5] has recommended additional considerations from key stakeholders such as the government, health-care systems, disability service providers, and institutions for PWD.

Even without the COVID-19 context, PWD experience various challenges such as reduced access to health services[9] and public transportation.[10] After the Alma-Ata Declaration, the WHO initiated community-based rehabilitation (CBR) for improving access to rehabilitation services for PWD in low- and middle-income countries.[11] The WHO, International Labour Office, and United Nations Educational, Scientific, and Cultural Organization jointly conceived CBR as "a strategy for general community development for the rehabilitation, equalization of opportunities, and social inclusion of all PWD."[12] CBR involves multiple stakeholders such as PWD, their families, governmental and nongovernmental organizations, and the general community."[13] Further, to provide comprehensive care for PWDs in community, multiple dimensions on health, education, livelihood, social, and empowerment have to be considered.[14] The sustainable scale-up of the CBR programs requires political commitment, participation of stakeholders especially at the national level, and financial support.[14] In Kerala, Kudumbashree, a state-supported women-centered poverty alleviation initiative, initiated a community-based rehabilitation program called "BUDS" (not an acronym) for inclusive and integrated education for individuals with intellectual impairments from poor families. There are BUDS schools for children below 18 years and BUDS rehabilitation centers for individuals above 18 years. We had undertaken a study of the role of local governments (LGs) in the establishment and functioning of these institutions as part of a broader study on decentralization and health in Kerala.[20] In this analysis, we explored the impact of COVID-19 on beneficiaries enrolled in the BUDS institutions and the organizational adaptation for continued operations during the period.

Methods

This was part of a larger study that explored the role of LGs in the establishment and functioning of the BUDS institutions in Kerala. The larger study adopted a thematic analysis[21] using an embedded design with a quantitative strand (secondary data) supplementing a predominantly qualitative design for examining how Kerala's local government has enhanced health-related initiatives and results.[20] The current study was qualitative and comprised in-depth interviews (thirteen in all, eight with BUDS school teachers, three with mothers of beneficiaries, and two with elected LG representatives). The data collection was continued until information saturation was reached as judged by the interviewer, where by no new data was shared by respondents. A document review of relevant guidelines and orders was also done. The detailed methodology and results have been published earlier.[20] The temporal reference of earlier analysis covered the initiation of the approach in 2004 to the present-day status and did not explore the functioning of the BUDS institutions, specifically during the COVID-19 pandemic. In this analysis, we explored the experiences of families of PWD using the BUDS services and response of the institutions for sustaining benefits and services during the pandemic period. A framework was developed based on the earlier analysis and portions of the transcripts were deductively coded into the analytical framework. The study was conducted after ethical clearance from the Institutional Ethics Committee of the Health Action by People, Thiruvananthapuram (IEC No EC2/P1/Sep/2020/HAP dated December 10, 2020). Electronically documented informed consent was obtained from all participants as the interviews were conducted virtually due to the COVID-19 pandemic-related restrictions.

Results

All schools continued to function in some capacity even when physically shut down. Trainer salaries continued to be paid and the money for food was utilized for provision of food kits to beneficiaries. We describe our themes in the following portion.

Theme 1: Challenges for families of children with disabilities

Lost interaction led to loss of some therapeutic gains

After the onset of the pandemic, families with children with disabilities had to face enormous challenges in the physical, mental, and social domains. Most trainers noted that during school days, they regularly trained children on the activities of daily living, but during the lockdown, children lost the skills gained at school.

> "We had a girl child, who was unable to eat food with her hands. Her mother used to feed her. When she came to school, at first, we fed her. Then we made her eat food with her own hands. During COVID, her parents send me the video of the child eating food all by herself. They were very happy. But now, she will not eat by herself and needs her mother to feed her" – Trainer 1.

Another trainer had the opinion that when children disagree to do chores, for example, washing hands, the parents would do it for them out of care, but cause further delay for the child in terms of gaining that skill. A trainer opined that their efforts of teaching children over years got "wasted." Further, children were frustrated, had lost interest in doing daily activities, and some started having issues related to weight gain.

> "We lost interaction, right?....When we ask them to do some activities, they are not interested now" – Trainer 6.

Parents were finding it difficult to control their child's anger and some children would often turn violent. Another trainer had the opinion that when children disagree to do chores, for example, washing hands, the parents would do it for them out of care, but cause further delay for the child in terms of gaining that skill.

Parents faced financial hardships

Not able to go for work

Care requirements and safety of the children were a concern that prevented parents from leaving them at home and going for work. Parents themselves were unable to go for regular jobs or even to nearby shops. Due to unemployment, parents felt caught in a vicious cycle of poverty whereby they have to take loans and were unable to repay them.

> "As the child is at home, many parents are unable to go for jobs. As there are financial constraints, many parents have taken loans. Only if they go for the job, they will be able to repay the loans" – Trainer 7.

Some parents demanded reopening of the schools once the lockdown was eased, and when some private institutions started opening but the reopening was deferred due to fear of infection.

Disruption of income-generating activities and vocational training

> "As part of vocational training, we started making paper pens, but due to corona we had to close down the school. So, we couldn't earn anything out of it" – Trainer 1.

Income-generating activities were modified to suit new requirements shaped by the pandemic and its control measures, like mask making, but opportunity to market such products was limited.

Theme 2: Organizational adaptation to the situation

Sustaining contact with children and parents

A self-drive of trainers and a sensitive approach to support the children and parents at least in the form of regular phone calls was very evident. Mobile phones became one of the most utilized mediums for communication and continued training. Using phones, the trainers provided information related to COVID-19 and the usage of sanitizers. A trainer with the support from two helpers in her school made systematic efforts to call all beneficiaries along with maintaining a tracking sheet.

> "I prepared a chart at first to prevent repeated calling. I prepared a list of children whom I should call and whom the helper chechi's to call. We made an order and we planned that staff should call two students daily. Three of us decided this, and we call 6 children in a day. So, each staff used to call students for the first 2 months" – Trainer 3.

The instant mobile messaging, WhatsApp, was used extensively in communication with parents. Parent groups were formed for communication and posting of group activities.

Limited utility of Thénkoodu, an app-based learning module

The COVID-19 opened up opportunity of Information and Communication Technology-based tools including online classes. This was an option considered favorable by elected representatives as it was not resource intensive and many classes could be recorded and shared. Student activities and training videos were shared with parents. Online classes were conducted through the Thénkoodu application. During the initial phase, trainers expressed that there was good competitive spirit among parents to do activities given to children and upload it. However, gradually, children refused to obey parents and do school activities. Trainers noted that the children listened to them more than their parents in such situations.

> "Many students do not obey the parents but as they are afraid of trainers, they will do it. Children are not afraid of their parents" – Trainer 7.

However, most trainers emphasized that the Thénkoodu app was not successful. One trainer opined that it was "around 30% useful." Children with mild to moderate intellectual disabilities watched the videos with parental support. Beneficiary side issues included inability to afford a smart phone and older persons and mothers being less comfortable with the mobile application and being dependent on the male counterparts in the family for technology-related tasks. Children were also likely to throw the phones (often hard earned) and damage them. Trainers had other reasons for not supporting the app, like the need for adequate support if a beneficiary is to use the app and the lack of equal impact as a physical session. Children in general recognized the trainer's voice and were motivated to make videos, rather than in response to other videos or classes. Table 1 depicts some of the quotes made by trainers when asked about the Thénkoodu app.

Distribution of necessities for children

The distribution of food kits and medications was regular, and most of the panchayats made sure it reached the families of children without fail. In some schools, panchayat members supplied provisions and medicines monthly when trainers could not. Some places had efforts to maintain supply of medicines and make health visits or referrals during the lockdown. Other than cereal kit distribution there was limited support from the Panchayat. Some panchayats made arrangements for the delivery of cereal kits at home as it was difficult for parents to come to school and collect them.

> "Usually, under the educational department students get cereal kits. The parents have to come in person and collect it. However, our panchayat made arrangements to supply these kits to their homes to avoid parent's difficulty" – Trainer 5.

Another panchayat thought that as the parents were benefiting from a kit costing about Indian Rupees 1500, it was fair to expect them to come to the BUDS center to collect the kit.

Home visits

In one school, as the school was closed, the panchayat staff visited children at their homes and distributed gifts and learning materials to commemorate the New Year as well as their Annual Day. In some schools, the panchayat president, ward counselor, or Kudumbashree Community Development

Table 1: Opinions on Thénkoodu app

Nature of objection	Quotes
Economic aspect	Trainer 3 - "Most parents in our school go for an employment guarantee program, only one parent is a trainer. These parents might not have time. We have the Thénkoodu app, but only two students use it correctly"
	Trainer 3 - "parents might be buying a mobile by saving money for a long time, so they are scared that the children will break the phone"
	Trainer 4 - "There were issues as only one person at home will have a smartphone"
	Trainer 8 - "I think only six of them (from around 40 beneficiaries) have (smart) phones"
Age	Trainer 2 - "But all parents couldn't do it because some parents were above 60–65 years. They did not know how to use it"
Gender	Trainer 2 - "when fathers leave home, these children do not have access to the phone"
	Trainer 4 - "Parents cannot log in and add the evaluation. Firstly, mothers have less knowledge on how to use smartphones. Fathers, brothers, and sisters will either go for a job or to study…most of them did not know to check the videos, make the child do the activity, and evaluate"
Parents prefer offline mode	Trainer 8 - "they just want to send the children to the school"
Phone not suitable for such children	Trainer 4 - "the child might throw the mobile"
	Trainer 8 - "The child would throw the phone after sometime"
Trainers prefer physical mode	Trainer 7 - "We can do it, but it does not have the impact of being in-person and teaching them"

Society chairperson accompanied the team for these home visits. Goods were purchased through sponsorship by the panchayat. In few schools, home visits were conducted by trainers weekly for training and distribution of study kits and cereals. They made a weekly schedule to cover all children in the school. They planned the home visits at school and after getting consent from parents and the trainers visited them. Financial support for home visits was not a uniform practice and was present in some places but not in others.

> "I: How did panchayat help when trainers started home visits? P: We did not get any help from the panchayat. We are spending from our own pockets for these home visits" – Trainer 4.

Discussion

We did a qualitative study on experiences of beneficiaries of BUDS centers as expressed by trainers and the role of LGs during the COVID-19 pandemic. The schools continued to function in some way, through phone-based contact, virtual training programs, home visits and distribution of food kits and medicines. The COVID-19 pandemic adversely affected CBR projects by restricted movements of goods and individuals. Health-care providers were unable to reach PWD and the reverse was also true.[15-17] A study done in Zimbabwe on community-based rehabilitation noted that during the COVID pandemic, there was reduction in frequency of health-care visits and unavailability of medications.[16] Our study found that PWDs and families faced some difficulties like disruptions in the rehabilitation trajectory of the child and financial difficulties for the parents. However, lack of access to treatments was not a major theme probably because of the active efforts of the trainers and the LGs. However, the heavy provider focus of our study may also be the reason for not getting challenges faced by beneficiaries. Nevertheless, the three parent interviews did not suggest any serious issues in this regard.

We discuss our findings pertaining to the role of LGs using the framework of organizational resilience proposed by Hillman and Guenther,[18] according to whom organizational resilience is "the ability of an organization to maintain functions and recover fast from adversity by mobilizing and accessing the resources needed." According to this framework, different factors such as the organization's resilient behavior, resources, and capabilities determine its resilience. Further, the end result of this response to the crises is organizational growth and learning. In the study, we found that the BUDS institutions strived hard for program sustainability by gathering available community resources and adapting to the unique needs of situation. In Table 2, we summarize our reflections on the findings within the framework of organizational resilience proposed by Hillmann and Guenther. Our main study conducted on the Kudumbashree-Local Self Government convergence model described the local level governance processes of BUDS establishment and expansion that paved the way for this resilience such that the institutions to continue to work in alternative ways even though there were disruptions on the day-to-day functioning.[20]

We were able to draw some parallels between our findings on resilience and a study done on CBR interventions for persons with serious mental illness in rural Karnataka. The CBR program for patients with mental illness run in collaboration with governmental and nongovernmental stakeholders offered home visits, free psychotropic drug distribution, facilitation of disability certificate, and regular residential camps. Even in the midst of demanding circumstances like transit restrictions, fund diversion for COVID-19 control activities, and general health system being overwhelmed by the pandemic, this particular CBR project displayed considerable resilience by continuing ongoing activities. Patients and their families were contacted regularly over phone for assessing symptoms and checking early signs of relapse and reminders for scheduled visits. Active collaboration by government, District Mental Health Program, and other stakeholders made sure that there is a seamless service delivery.

Other health worker-driven community-based programs have also shown the role of leveraging existing resources and

Table 2: Study findings mapped against framework of organizational resilience of Hillman and Guenther

Concept	What our findings suggest
Resilient behavior	Acceptance of risk, and trying non-physical means of training
Acceptance/facing down reality	Some panchayats embraced home visits by providers as against transportation of beneficiaries to centers
Conquering denial	
Avoidance	
Embracing paradox	
Resilience resources	Sheer dedication of trainers and some LG representatives toward the children and their families, sensitive to beneficiary contexts and needs
Relational	
Emotional	Decision-making structures, guidelines at local level to make context specific decisions
Cognitive	
Structural	
Resilience capabilities	Using cues from the pandemic control measures being rolled out
Anticipation	Anticipating disruptions to usual life of PWD beneficiaries and families
Sense making	
Resilient response	Immediate issue of guidelines to continue food kit distribution and remuneration of trainers
Maintenance of functions	
Time of recovery	Some delay in physical re-opening, justifiable considering infection control
Resource access	

PWD: People with disability

orienting health workers to continue to function even during exceptionally difficult circumstances raised by the COVID-19 pandemic situation. A study on a maternal and neonatal health program namely "Mamás del Río (MDR)" in Peru demonstrated similar findings of resilience during COVID-19 pandemic, but this was not a rehabilitation program. The MDR program mainly focuses on essential newborn care, home visits by community health workers (CHWs), and training for traditional birth attendants. During the COVID-19 pandemic, through telephone calls, existing resources, and training to CHWs to reduce infection risk during home visits, many CHWs were able to continue their maternal and newborn care activities. The study also emphasized that locally run programs could leverage existing infrastructure and capacities during an emergency. These studies and our findings are in line with the recommendation of Akbari *et al*.[19] in 2021, who proposed that home-based rehabilitation models can be a "sustainable solution" during a pandemic crisis as utilization of state-of-the-art technologies can be challenging due to COVID-19-related challenges. Various models of community-based rehabilitation programs around the globe reflect the resilience and responsiveness displayed by the organizations for program sustainability. However, there remains insufficient literature on case studies of community-based rehabilitation organizations during the COVID-19 pandemic and we believe that our study adds to scholarly literature in this area.

Our study has certain limitations. As mentioned, the focus is heavily on the provider side as most of the data collection was from trainers and LGs. However, PJ and RPV have considerable experience with BUDS institutions and we believe that gross departures from the findings are unlikely. Moreover, the three beneficiary interviews also did not suggest otherwise. Another limitation was the remote nature of the electronic interviews and deductive approach for analysis that we used – We may have missed some understated findings. We recommend further studies for in-depth exploration of the impact of COVID-19 on CBR programs from the perspectives of different stakeholders involved.

Conclusion

LG entities own the BUDS institutions with the cooperation and supervision of a women's self-help group (Kudumbashree) and the community structure. PWDs of various ages and their families rely on these institutions for education, recreation, and employment, either directly or indirectly. The COVID-19 breakout resulted in the deployment of a statewide lockdown, which affected the operation and closure of BUDS institutions. Beneficiaries clearly experience disruptions in their rehabilitation trajectory, while families experienced increased financial difficulties. Prompt action on the part of BUDS teachers has helped mitigate the impact of the COVID epidemic to some extent. LGs have made some efforts to ensure the social security of differently abled children and their families a priority. Furthermore, initiatives for institutional sustainability were undertaken. We conclude that the LG-driven community-based BUDS institutions showed commendable resilience during the early pandemic period.

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There are no conflicts of interest.

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Original Article

Role of Local Governments and the Challenges Involved in Implementing the Elderly Care Initiatives in Kerala

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Abstract

Background: Among the states of India, Kerala is likely to be the first aging society, and it is one of the pioneers to introduce a senior citizen policy of its own. Elderly care in the state is an integrated effort of many departments with local governments (LGs) playing a major role. This comes with many challenges at different levels of the policy implementation. **Methodology:** A qualitative approach is used involving document review, key informant interviews, and secondary data analysis. **Results:** The results are organized under four themes: (1) decentralized governance and elderly care, (2) the role of various stakeholders other than LG in elderly care initiatives, (3) challenges in planning and implementation of elderly care programs, and (4) from State Old Age Policy (2006) to State Policy for Senior Citizens (2013). The existing projects are mostly focused on nutrition, infrastructure facilities, and treatment of noncommunicable diseases, while challenges such as feminization of age and specific needs of the heterogeneous elderly population are least prioritized. **Conclusion:** Secondary data analysis and the perspectives from stakeholders at different levels of the system emphasize the inefficient utilization of allocated funds, inadequacy of domain experts, capacity building facilities and situation analysis during the planning process, and lack of consistent monitoring and evaluation of existing projects. While the LGs have a major role in the planning and implementation of elderly care initiatives, the existing gaps identified from the study show that there is a need for a better framework and a holistic vision to effectively integrate various stakeholders in elderly care with a right-based perspective.

Keywords: Decentralized governance, elderly, elderly care, Kerala, local governments

Introduction

Population aging is a global phenomenon. Partridge and Mangel defined aging as "An increase in mortality and/or decline in fertility with advancing age."[1] The demographic transition has resulted in a shift from the younger population to the elderly population, which has led to complex health, social, and economic challenges that are expected to worsen in the future.[2] India is no exception to this trend, with 8.6% of the population, around 104 million elderly persons, being 60 years or older as per the 2011 census.[3] Kerala has a higher proportion of elderly persons than other states, with 7.4 million people above 60 years of age.[2] This difference has been most often attributed to the higher out-migration status of Kerala.[3] The health aspects of aging are intertwined with the transformation that occurred in the structure of families throughout the historical evolution of Kerala society. Urbanization has also contributed to this change in family structure, community norms, and traditional social networks.[4-7]

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The elderly population requires special attention in terms of health and health-related challenges, as they are largely exposed to illnesses, unlike other age groups. A survey conducted in 2011 among the elderly in Kerala assessing the morbidity pattern of elderly persons showed that the morbidity load of the elderly in Kerala is comprised of noncommunicable diseases more than communicable diseases. This results in a high number of elderly persons with chronic health issues and thereby increases out-of-pocket expenditure.[2] The proportion

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of elderly women in Kerala exceeds the national average by almost 20%, while men represent only 9% of the elderly population. Moreover, research suggests that elderly women in Kerala exhibit a distinct mortality pattern, pointing to an advanced aging process that merits further investigation.[4,8,9]

Kerala was the first state in India to implement a State Old Age Policy of its own in 2006 by the Social Justice Department (SJD), which was later modified in 2013 as the State policy for Senior Citizens.[3] Although elderly care in Kerala is an integrated effort of many departments, local governments (LG) have a major role in managing the different dimensions of geriatric care and are bound to provide 5% of their plan fund for the purpose. Some state initiatives for elderly care include Vayoamrutham, Aswasakiranam, and caregivers for institutions introduced by the SJD and Vayomithram by the Kerala Social Security Mission (KSSM) jointly with the local self-governments. These programs currently provide health care and support to people over 65 years, with free medicines, palliative care, and counseling services.[10]

There are studies on health-care utilization, health-care behaviors, and quality of life of the elderly in Kerala.[11-13] However, with limited documentation available on the prevailing projects implemented by local self-governments and departments, there is a large gap in the literature on how elderly care is undertaken by the decentralized health sector in Kerala. This study aims to look at the role of LGs in the implementation of projects and programs for the protection and promotion of the health and welfare of senior citizens in Kerala and the challenges involved in it. The study tries to shed light on the effectiveness of various programs and initiatives undertaken by the LGs and to suggest ways to improve elderly care in Kerala.

Methodology

A qualitative approach was used involving document review, key informant interviews (KII), and secondary data analysis. Content analysis is the qualitative methodology used for the study. KIIs were conducted over video calls and were electronically recorded, due to COVID-19 restrictions. The key informants were selected through purposive sampling based on their experience and contributions to the planning and implementation of elderly care programs in Kerala. Separate semi-structured in-depth interview guides were prepared for each category of stakeholders.

The study interviewed six key informants who had expertise in different sectors related to elderly care in Kerala. All informants were men above the age of 40 years. The participant profile is provided in Table 1.

The data on fund allocation and expenditure of elderly care projects under LGs in Kerala from 2014 to 2020 were collected from the Information Kerala Mission. Furthermore, the study reviewed Kerala State Policy for Senior Citizens, 2013 (G.O [Ms.] No.37/2013/SJD dt. May 06, 2013), and the program documents from the SJD on elderly care programs available in the public domain as part of the document review.

Table 1: The participant profile of key informant interviews

Code	Representing/related sector	Level of position
KII1	State government	Senior, retired
KII2	Social justice department	Senior, retired
KII3	Social activist	Senior
KII4	Health department	Mid-level
KII5	LG (Grama Panchayat)	Senior
KII6	Academician (geriatric studies)	Senior

KII: Key informant interviews, LG: Local governments

Among the authors, DCS conducted the KIIs and analysis. QualCoder (open-source software) was used for qualitative coding and thematic analysis, while version 24 and Microsoft Excel were used for quantitative analysis.

Ethical clearance

The study was part of the larger research project on LGs and health in Kerala, and the main study had received the requisite ethical clearances from the IEC of Health Action by People, Thiruvananthapuram (IEC. NoEC2/P1/Sep/2020/HAP December 10th, 2020). Informed consent was electronically recorded, and all transcripts and reports were anonymized.

Results

The findings from the study are grouped based on the themes from the in-depth interview guide.

1. Decentralized governance and elderly care
2. Role of various stakeholders other than LGs in elderly care initiatives
3. Challenges in planning and implementation of elderly care programs
4. From State Old Age Policy (2006) to State Policy for Senior Citizens (2013).

Decentralized governance and elderly care

Decentralization has helped prioritize elderly care in participatory planning at the local level. In the initial years of decentralized governance in Kerala, only gender-specific programs were prioritized to address the needs of vulnerable groups. After 5 years, 5% of the total plan was allocated to each LG for children, the elderly, and persons with disabilities. This allocation increased by 5% specifically for elderly and palliative care. Following this, health facilities and panchayats made efforts to become elderly-friendly institutions. According to a key informant from the health department, it was the introduction of the Ardram Mission that made elderly-friendly infrastructure mandatory.

The involvement of the elderly population in expressing their needs and participating in community platforms like Gramasabha is pivotal in formulating projects targeting the elderly.

> *"They form the greatest number of participants. It is evident from the attendance book. Another important thing*

is after turning 60 they carry out almost all the menial tasks like getting groceries, picking up the kids from schools, attending the Gramasabha, and such." - KII5

The majority of participants in Gramasabha are women, as per the panchayat representative. Elderly male members often do not participate as they are not active earning members of society. A feeling of low self-esteem and self-worth among elderly men after retirement which holds them from being involved in developmental processes also reflects the attitude of the society toward the elderly and gender roles. However, the expertise and experience of elderly persons should be valued, according to three of the key informants. Gramasabha is not often considered a constructive platform for community participation or democratic governance by society. They often consider women and the elderly as weaker sections, who are not expected to make decisions or handle powerful positions. To increase the active participation of the elderly population, a special elderly Gramasabha was suggested but was be implemented successfully. While elderly persons' participation in Gramasabha is often passive, there is concern about the extent of their involvement in decision-making.

Role of various stakeholders other than local governments in elderly care initiatives

The KSSM and the SJD are responsible for improving the service delivery for bedridden patients and strengthening old age care homes, whereas the LGs focus on social security schemes like elderly pensions. The revenue department monitors the implementation of the process. The health department is responsible for the health care of the elderly, a significant component of elderly care.

According to the respondents from the health department, state and national programs targeting the elderly population are working synergistically with palliative care services under each primary health center (PHC). LGs coordinate this as directed in the state policy. During the COVID-19 pandemic, the elderly were prioritized as a vulnerable population, and medicines were distributed at the doorstep for elderly patients who could not reach PHCs, with the support of LGs. It was carried out under the leadership of the Ward Health, Nutrition, and Sanitation Committee in every ward, chaired by the ward member.

Most key informants consider Kudumbashree, the best platform to create awareness among people regarding the rights and services of senior citizens. The lower structure, "Ayalkkoottam," is more effective as it facilitates better communication at the local level. However, the higher expectations over Kudumbashree are often rooted in gender stereotyping, assuming women are the primary caretakers of elderly persons at home.

All key informants expressed that SJD and KSSM are not equipped enough to advise and coordinate elderly care activities in the state. According to the health department representative, there was better coordination when both the health and SJD were under the power of the same minister. That enabled a coordination committee for elderly care comprising the health, social justice, women, and child departments, along with Kudumbashree.

"Vayomithram is doing the same thing, sometimes duplication occurs, some people get services from both places while some may not get services only. In such places, if there is proper coordination, we can prevent duplication of services and can take the reach to a maximum number of people. We have understood the value of coordination over the last 5 years and we need to take it forward." - KII4

Interdepartmental coordination in planning and implementing efficient elderly care programs at the state and grassroots levels has emerged as a key factor in all the KIIs. According to the academician in the field, this also demands the need for an organized effort from elderly citizens and elderly self-help groups at different levels. However, he finds the elderly population themselves a disorganized section, despite efforts such as "vayojana ayalkkoottam," which did not work as envisaged. Efforts for other elderly self-help groups were also not up to expectations.

Challenges in planning and implementation of elderly care programs

One of the KIIs were the elected representative in the Grama Panchayat that coordinated an innovative project for the elderly called the age-friendly panchayat in 2013–2014. While the program started off well, it eventually became a program for its namesake. He believes that this was due to a lack of mandate or law-bound measures to ensure and monitor the implementation of the project. Inadequate training of new officials who joined the program, transfer of skilled officials, the inefficiency of monitoring and evaluation mechanisms, absence of compassion and empathy among implementing officers, and lack of proper situation analysis also contributed to the program's failure. The key informant believes that project preparation has become an exercise in adhering to the predetermined fund dissemination process instead of focusing on need-based programs.

According to the state policy guidelines of 2013, LGs are required to allocate 5% of their plan fund for elderly welfare projects. From 2014 to 2020, the total fund allocation for both infrastructure and elderly care activities increased, but the amount allocated for infrastructure was higher than that of elderly care activities [Appendix 1 and Footnote].

Figure 1 shows the total fund allocation for elderly care projects from 2014 to 2020. A notable finding is that although funds were allocated more to infrastructure, the total expenditure was higher for activities related to elderly care [Figure 2]. There was almost no expenditure on infrastructure during the 2-year period.

Figure 2 indicates that there is a significant gap between the amount allocated and the expenditure on elderly care projects. This supports the argument that there is a lack of expertise in

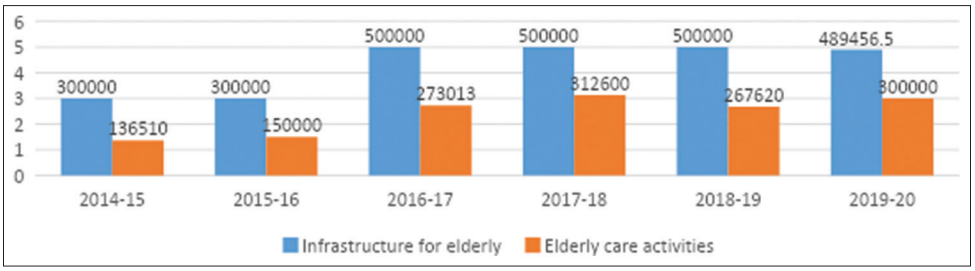

Figure 1: Total fund allocation on elderly care projects from 2014 to 2020

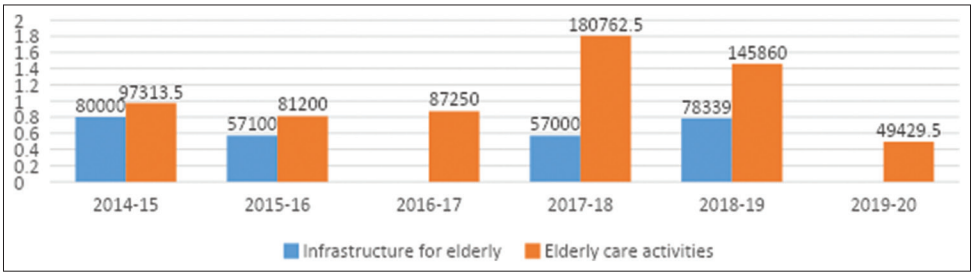

Figure 2: Total fund expenditure on elderly care projects from 2014 to 2020

planning and implementing such projects. Further analysis reveals that the majority of the funds allocated for elderly care activities were spent on the Vayomitram program, which is the share of urban bodies transferred to KSSM for implementation of the program [Figure 3].

Figure 3 illustrates that although the total allocated funds to KSSM were fully utilized, there was a large gap in the allocation and expenditure on projects handled by LGs, indicating poor planning and a lack of expertise at the local level. Urban LG institutions allocated higher or equal funds to activities for elderly welfare than to infrastructure, unlike rural LG bodies. The higher expenditure on elderly care activities in urban areas is largely due to the share of urban local bodies for the Vayomitram project, which contributes to the largest portion of the funds for elderly welfare activities.

From State Old Age Policy (2006) to State Policy for Senior Citizens (2013)

The 2006 policy did not specifically address the needs of the elderly, except for the provision of pensions. The revised and comprehensive policy, introduced in 2013, has not been effectively implemented due to poor communication between the SJD and LG institutions according to the KIIs. The lack of an implementation plan and monitoring system has led to unclear operations at the grassroots level. Panchayat representatives have also complained about the lack of information passed down to them about the policy and its implementation.

> *"Well, actually the nodal agency for the welfare of the people at old age is the SJD and the SJD does much of its work through the KSSM and these two people, these two agencies are doing a lot of work. But if you compare the policy statements and policy requirements with their activities, you will find that there's a big gap between all these things."* - *KII6*

Although the 2013 policy was more rights based, rather than welfare based, there have been limitations in its implementation.

> "*When we perform a comparative analysis between both first policies of palliative care and elderly care. The former's intent and design are to have a more focused vision while the latter's intent and design are broader. Due to this reason translating the intent into action was difficult for elderly care.*" - *KII1*

Half of the respondents identified a lack of holistic planning and domain expertise as a major setback in the government's elderly care programs. Many panchayats had standalone projects without a holistic approach, which often did not sustain. Most often, the needs of the elderly were only focused on food and medical care. The lack of domain experts in the planning process was explicit. As a result, projects at the panchayat level were often limited to the distribution of assistive devices or the construction of Pakalveedu (daycare facility).

LGs have a significant role only in the implementation of a few initiatives, such as Sayamprabha and Vayomitram, not in others such as Vayo Amrutham, Vayomadhuram, Mandahasam, or psychosocial care in old-age homes.

Discussion

The study aimed to investigate the contribution of LGs in elderly care initiatives in Kerala, India. The findings indicate significant progress in elderly care programs in Kerala due to the involvement of local-level planning. Kerala stands out in India due to its large elderly population and unique measures

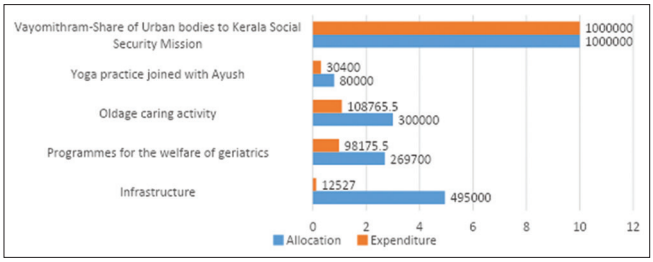

Figure 3: Total allocation and expenditure on elderly care projects

taken to reach out to them.[3] Although various state-level and national-level programs for the elderly exist, LGs have a crucial role in their implementation. Decentralized governance in Kerala has spearheaded efforts to prioritize elderly care. The state policy document and the KIIs endorse the importance of interventions at the local level to address the challenges faced by the elderly. Elderly participation in the decision-making process at the local level is necessary to ensure a rights-based approach to policy implementation. Decentralized governance in Kerala has initiated such platforms at the local level and has been successful in many panchayats. While elderly care was not a priority initially, it has gained importance over time with this. The allocation of a special fund for elderly care and innovative initiatives by many panchayats indicate the change. However, the study also highlights the lack of technical expertise to guide effective interventions to address the needs of the elderly and the absence of continuous capacity building of stakeholders on managing such programs.

In Sweden, where elderly care has evolved as a model, LGs were given a higher degree of choice in organizing elderly care, and they took over the responsibility of home-based nursing in the early 1950s.[14,15] Similar to the context in Kerala, municipalities in Sweden design elderly care services adapted to local conditions. However, they are exploring extensive changes in elderly care by increasing the role of the private sector.[16] In Kerala, a large number of institutions providing elderly care belong to the private sector, but the integration of the private sector in elderly care programs is limited.

The health care of the elderly is critical, considering their high morbidity and low economic productivity. Despite the availability of insurance schemes such as comprehensive health insurance scheme (CHIS), inconsistent disbursal and low coverage of pension schemes have increased their out-of-pocket expenditure.[17] However, the inclusion of palliative care among mandatory projects at the LG level has enhanced the coverage of palliative services in Kerala, reducing the burden on the elderly.[18] The convergence between national health mission (NHM), Kudumbashree, the health department, and other nongovernmental organizations has also improved.

A study conducted among the elderly in an urban setting in Kerala reveals that only 60.5% have regular health checkups, and only 28.9% use primary health-care services.[19] These challenges can be overcome through LGs' involvement in coordination with ground-level health workers and the health department. The role of elderly self-help groups in facilitating elderly care programs is significant.[20] The study also points out a lack of expertise in geriatric care in the health department and an emphasis on nutrition and curative medicine or palliative care.

This study revealed three major themes that need to be addressed to improve the initiatives for elderly care.

Lack of capacity within the system to undertake initiatives

This includes the lack of technical expertise and domain experts in planning and implementing the programs. In the existing system, identifying priorities and allocation and expenditure of resources based on the specific needs of the elderly population prevails as a challenge. To address this, the study suggests adopting mechanisms like the Voluntary Technical Corps that existed during the people's planning campaign as a good model.

Need for elderly engagement in decision-making and management

The trivialization of the needs of the elderly, based on their gender, financial, physical, and mental conditions, within the family and community platforms such as Gramasabha, working groups, and community-based organizations is highly discriminatory. This leads to inefficient utilization of resources and defective planning for healthy aging in the community.

Need for intersectoral coordination

Although many innovative programs and well-planned processes have been implemented targeting the elderly, they have not been sustained for long due to the lack of motivation among program managers, lack of ownership among different departments, and efficient monitoring and evaluation mechanisms. Therefore, it is crucial to promote intersectoral coordination and collaboration to ensure the sustainability of elderly care initiatives.

In conclusion, LGs play a crucial role in implementing elderly care programs in Kerala. While there has been significant progress, challenges remain in addressing the needs of the elderly effectively. LGs need to work with other stakeholders to improve the health and well-being of the elderly population. Capacity building of elected representatives and health workers, along with technical expertise in geriatric care, is pivotal to achieve this goal.

Limitation of the study

This study has a major limitation since the perspectives of ground-level health workers, LG actors, elderly care program beneficiaries, and senior citizen representatives facing diverse issues of gender and age were not explored in detail. Further research is necessary to investigate the influence of social and political determinants of health in elderly care provisions in Kerala state and how LGs can address them.

Conclusion

In Kerala, decentralized governance has enabled a shift in

prioritizing elderly care by creating opportunities for the elderly to participate in decision-making and development. Different departments play significant roles in leading and coordinating with the LGs. However, inadequate interdepartmental coordination is a major shortcoming in the state's elderly care activities. While the utilization of funds at the panchayat level has improved, there is room for more efficient utilization and need-based project preparation. To address this, capacity building and the involvement of domain experts in the planning process are necessary, with the state providing technical and financial support. In addition, incorporating medical/health care with judicious care can be effective. Establishing a regulatory framework that emphasizes the rights of the elderly would encourage LGs, institutions, and families to take responsibility and ownership of caring for the elderly.

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Conflicts of interest

There are no conflicts of interest.

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Appendix 1: Microsector classification

Microsector	Group
Repair of government institutions for geriatrics	Infrastructure for elderly care
Repair of old-age home building	
Repair of government destitute homes	
Installation of solar lights in old-age homes	
Increasing facilities in old-age homes	
Repair of "Pakalveedu"	
Purchase of equipment for old-age homes	
Purchase of land for old-age homes	
Construction of old-age homes	
Purchase of furniture for old-age homes	
Construction of "Pakalveedu"	
Old age caring activity	Activities for the health and welfare of the elderly
Vayomithram – share of urban bodies to the Kerala Social Security Mission	
Yoga practice joined with Ayush	
Programs for the welfare of geriatrics	

The data on fund allocation and expenditure on elderly care projects under local self-governments in Kerala from 2014 to 2020 were collected from the Information Kerala Mission. These data illustrate the plan outlay from 2014 to 2020 under sectors, subsectors, and microsectors. The microsectors in the data were grouped into 1. Infrastructure for elderly care and 2. Activities for health and welfare of elderly for a meaningful analysis. The median of total allocation and total expenditure of funds on projects under the microsectors on elderly care were compared based on the type of local body and group of microsectors

Original Article

Urban Health Sector in South Kerala: Exploring the Role of Local Government Institutions

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Abstract

Background: Following rapid urbanization in Kerala, the urban population grew faster with different health needs, widening the socioeconomic and health inequity. The urban primary health centers were formed, and with the introduction of decentralized governance, the primary and secondary health-care facilities in the urban region were transferred to the urban local bodies (ULBs) such as corporations and municipalities. This study tried to explore the role of the local government institutions in the urban health sector of Kerala. **Methodology:** Qualitative approaching was used involving in-depth interviews and secondary data analysis of health financing data from ULBs. The settings were purposively chosen from different levels of ULBs in South Kerala. **Results:** The in-depth interviews were analyzed deductively based on the themes evolved from the larger project. The major finding of the study was organized under the themes: (1) fund allocation and resource mobilization, (2) drinking water and waste management, (3) challenges in project implementation, (4) health care of vulnerable populations under the ULBs, and (5) Kudumbashree and community participation. **Conclusion:** The findings from thematic analysis and secondary data analysis lead to the conclusion that most of the ULBs focused on health-related domains such as sanitation, drinking water, waste management, and nutrition. The financial and administrative support given to health facilities was limited due to many factors including lack of resource availability, low autonomy, and low community participation. Despite this, many ULBs made efforts to collaborate with health facilities and other stakeholders to implement innovative and need-based health projects.

Keywords: Kerala, local government, urban health

Introduction

The global population witnessed a rapid "urban shift" in many countries during the last century. The industrial revolution has largely contributed to this by facilitating rural–urban migration. The urban population in India is growing at a rate of 2.76% per annum according to the 2011 census, making it 377 million.[1] The state of Kerala holds the 9th position in the level of urbanization in India with 92.72% of urban population growth during the past decade.[2,3] With this increasing population and utilization of resources in urban settings, socioeconomic inequities also start widening. Urbanization resulted in higher income and socioeconomic inequality pushing many to the outskirts of the urban area as underprivileged and marginalized. The urban poor were excluded from availing of quality health service delivery systems and access to other determinants of health. Thus, public health needs emerged as a major challenge.

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The rapid growth of private hospitals and increasing noncommunicable diseases in the state weakened the public health facilities and increased the out-of-pocket expenditure of the poor population.[4] In 1996, with the introduction of the decentralized governance system in the health sector of Kerala, the primary and secondary health institutions in the state were transferred to the local government Institutions. According to the 2011 census, currently, Kerala has 978 grama panchayats, 152 block panchayats, 14 district panchayats, 60 municipalities, and 5 municipal corporations. Urban local

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bodies (ULBs) like municipalities and corporations deal with a wide range of public health issues ranging from drinking water availability, waste management, and sanitation.

Urban PHCs were implemented under National Urban Health Mission (NUHM) aiming to cater for the urban poor. This was implemented by Kerala state in 2014. The urban slum population in Kerala is significantly lower compared to other states in India.[5] Since the primary and secondary health-care facilities in the urban area are under the urban local body (ULB), it is worth exploring what role they play in managing urban health care in Kerala.

Methodology

The objective of the study was to understand the role of local government institutions in the urban health sector of Kerala. For this exploratory study, we adopted a qualitative approach involving in-depth interviews and secondary data analysis. The in-depth interviews were conducted among different stakeholders purposively selected from ULBs including 2 block panchayats, 2 municipalities, and 1 corporation in South Kerala. The profile of the participants of the in-depth interviews is given in Table 1.

Our data analysis followed a deductive approach, with predetermined themes derived from the domains identified in the overarching study titled "Decentralisation and local decision making in health: The Kerala experience."

Results

The findings from the in-depth interview are given as follows.

Fund allocation and resource mobilization

In some settings, the lack of adequate funds was considered a significant obstacle. Nevertheless, many areas had devised practical solutions to address this issue, such as partnering with private clinics for laboratory investigations. Conversely, even when projects are allocated sufficient funds, technical challenges like delays in fund disbursement can impede their successful implementation. The fund deficiency when not addressed at the institutional level or policy level has also pushed the dedicated governing committee member or the medical officer to spend it from their pocket to complete the project implementation. While this is not an advisable or healthy practice for the system, on the other side, many essential project proposals were rejected in the working group during the initial planning stage itself without exploring options to address the fund deficiency.

Table 1: Profile of participants of in-depth interviews

Participants	*n*
President	1
Vice president	2
Standing committee chairperson	3
Secretary	3
SC promoter	2
Medical officer	3
Panchayat member	1
CDS chairperson	1
ICDS supervisor	1
HI	2
Kudumbasree volunteers	5
ASHA	3
Haritha Karma Sena member	2

ASHA: Accredited social health activist, ICDS; Integrated child development services, HI: Health inspector, SC: Scheduled cast, CDS: Community development society

Many local bodies efficiently explored alternative funding options for projects. Below is an experience shared by the president of a block panchayat.

"There were instances where funds were not enough. We have done exceptional activities in the domain of sanitation and waste management which is difficult to find anywhere else. We have deliberately requested and received the funds from the 'Suchitwa mission' of around 27 lakhs and added a part of our fund along with that. Then the nursery which was implemented in 'bio village,' was managed with the 7 lakhs given by the agricultural department. We constructed a building and other facilities there with the money received from MLA's wealth development fund. We have to make use of such options. – President, BP."

Drinking water and waste management a priority

The ULBs pay greater attention toward drinking water and waste management programs. Here, the municipality manages a centralized water supply system, which supplies water to the households. For regions beyond its reach, the municipality installed separate pipe connections or constructed wells. The block panchayat also introduced a drinking water project in an outskirt region inhabited by Dalit families.

As per the standing committee chairperson, since there are not many flats or apartments, household waste management is not that difficult and they have managed to provide kitchen bins and composting facilities to the residents. Plastic wastes are cleaned at the source and collected by the municipality. Waste generated in towns, markets, and shops remains a problem. Municipalities have tried to implement the green protocol and installed mechanisms for waste management such as material recovery facility centers and shredding and waving units. One of the municipalities is doing it efficiently and they were recognized by the state for their good work. One of the municipality secretaries added that 15% of their plan fund was used for sanitation and waste management, making it a larger share.

Unlike the municipality, corporation had a hard time in waste management as the people tend to throw the waste in open spaces, said the councilor. According to the health inspector under corporation, they have done appreciable work before COVID-19, which involved great effort and community participation. He mentioned that in the past 5 years, the corporation developed a model in sanitation through different initiatives. The behavioral modification activities targeting

community participation and involvement of student collectives like "green army" are part of this.

Challenges in project implementation

The community development society (CDS) chairperson opined that the transfer or retirement of officials who manage the projects poses a real challenge in the implementation of projects. Once a project is approved and slowed down because of transfer of an officer, it becomes an issue in the review meeting at district planning committee (DPC). Audit objection has been stated as a barrier to project implementation by different stakeholders.

Low autonomy of power

Frequent fund shortages among block panchayats and municipalities have hindered effective planning and implementation. Some have taken risks to address this by facing audit objections, mobilizing external funds, or collaborations. However, many elected representatives cite a lack of autonomy as a significant barrier.

Despite funding challenges, urban local bodies (ULBs) have made efforts to address these issues through various means. Some elected representatives, who were part of the study, believe that the motivation for such proactive measures is constrained due to ULBs having less autonomy compared to grama panchayats.

Conflict of interests and ideas

Conflicting ideas among stakeholders within the same team are a prevalent issue across governing bodies. For instance, a municipality secretary noted that elected members often prioritize infrastructural improvements for healthcare facilities while neglecting funding for other health-related activities. Despite the recognized need for improved interdepartmental coordination, there's a suggestion for the establishment of a dedicated department to facilitate convergence and monitor communication between departments. Deficient communication is identified as a significant challenge.

There exists a conflict of ideas among the elected members and the implementing officers in health, which sometimes result in the withdrawal of already existing programs. For example,

"It was during the time I was the supervisor that the program 'Jagratha Samithi' to prevent the attack on women and children. It was carried out very well during the 2006–2007 period the panchayats president was very good and supportive and we were able to provide help to women even after 3 years, but after that, the new panchayats president came and he asked whether there was a need for this program, he began to blame us because we started the program and they were not willing to continue it and the people came to them and questioned them why they are not continuing the programs. They knew members began to hold grudge against us for starting 'unnecessary programs.' – Medical officer (MO), CHC."

Lack of resources and innovative initiatives

Innovative initiatives are facilitated by many factors such as collective effort, expert opinion, local needs, and situation analysis. This can be favored by different factors. In urban health, innovative initiatives that we came across mostly focused on nutrition and health-care service delivery.

A block panchayat, lacking a modern medicine Community Health Center (CHC) within its jurisdiction, opted to allocate maximum funding to support the government homeopathy hospital under its purview. This initiative served as a catalyst for the homeopathy medical officer to propose various innovative projects. These initiatives included a comprehensive healthcare plan encompassing home visits and awareness classes.

In a contrasting scenario, another municipality solely possessed seven subcenters as its public health facilities, with the district hospital falling under the jurisdiction of the district panchayat. Given this setup, the municipality endeavored to bolster the subcenters with the available resources.

These instances underscore the impact of stringent mandates and prioritization outlined in guidelines. They highlight how limitations in funding can paradoxically drive enhancements in facilities. Consequently, both rigid planning guidelines from the government and inadequate infrastructure and facilities under Urban Local Bodies (ULBs) act as factors influencing the implementation of innovative projects.

Health care of vulnerable populations under the urban local bodies

Urbanization rates are on the rise in Kerala, accompanied by increased migration to urban areas. The medical officer at the Taluk hospital observes that the population's higher health literacy has led to a greater demand for advanced healthcare services. However, there remains a concern regarding the availability of dialysis facilities and advanced cancer treatment at secondary-level health facilities.

In areas like the corporation, characterized by constant population movement, sanitation and waste management take precedence. Committee members have organized sanitation efforts across the corporation through health circle offices. The standing committee chairperson emphasizes that a significant portion of the allocated funds for the local body is directed towards public works, the health sector, and sanitation initiatives.

Marginalized communities and urban local bodies

The urban area has different areas with a higher population of marginalized populations. In the settings we explored, there was some scheduled caste (SC) colonies.

As per SC Promoters, Covid 19 Pandemic has been the most challenging situation. During this, ASHAs played a pivotal role in disseminating health education among Dalit communities, urging them to access nearest healthcare services and adopt preventive health measures.

The SC community members residing in colonies often face challenges due to their reliance on seasonal employment, which renders managing expenses during the off-season difficult. This

predicament is recognized by both SC promoters and panchayat officials as a significant health determinant. SC promoter said that they have been supported by the municipality and block panchayat with ration, subsidy, despite receiving support from the municipality and block panchayat in the form of ration assistance, subsidies, educational aid for children, and infrastructural facilities, the lack of permanent employment remains a persistent issue. To address this, the municipality came up with different projects to promote self-employment among women and the elderly in the community. They have also tried to address the basic infrastructural needs of the colonies allocating funds for drinking water projects and housing projects. According to ASHAs, alcohol and tobacco consumption is also a health issue prevailing in the Dalit colonies. Kudumbashree in collaboration with the municipality and health center organized cancer screening in SC colonies. The ASHA believes that dependence on alcohol and tobacco is leading to a higher prevalence of cancer patients in the colonies.

Women's health

During our review of documents pertaining to fund allocation and expenditure within state local governments, it became apparent that only a limited number of projects were specifically targeted towards women's health. This issue wasn't raised as a significant concern by the majority of elected representatives, except for a few. The Lady ward councilor representing the corporation highlighted several major constraints in addressing women's health issues.

"Mainly I feel that intervention in the health of women is needed. Like public toilets for women, as a woman who travels frequently, I have personally found this most difficult. A personal hygiene campaign for women is needed. But there is an issue that there are no public toilets and there is a risk of getting infections from the existing public toilets. So, we have to create toilets before creating awareness among them. Something we can do is to educate school children and college students on how to manage wastes that have been generated at their houses. That can have an impact on the houses because they can suggest measures and make people at home aware of facilities availed by the corporation for waste management. – Lady Ward councillor under corporation."

The councilor underscored the necessity for breastfeeding centers in prominent public areas within the municipality. Similarly, the Development Standing Committee chairperson at the corporation acknowledged these issues as significant but noted a lack of demand, even among women themselves. Despite efforts to introduce modern restroom facilities for women, including initiatives within the corporation compound, acquiring the necessary land posed a challenge. He lamented the dismissive attitude towards such projects, often labeled as mere "toilets."

These discussions highlight the crucial intersection of sanitation and reproductive healthcare in urban settings. The demand for clean restrooms and breastfeeding facilities, especially in areas with high employment and educational activities, is substantial. However, these needs have been largely overlooked unless advocated for by a woman-elected representative. The gender barriers in the governing system and society are also taking a toll on women's health in urban areas. Although the situation is more or less similar in the rural areas, the requirement for public restrooms seems to be high in urban areas and most of the existing ones are built near the highways and bus stations but are less likely well maintained.

According to the Integrated child development services (ICDS) supervisor under the municipality, the anganwadis are generally functioning effectively, largely due to the mandatory requirements set forth by government guidelines. Remarkably, during the pandemic and lockdowns, anganwadi workers and ICDS members displayed exceptional dedication, addressing both nutritional requirements and community healthcare needs. ICDS representatives further highlighted the collaborative efforts between ULBs and themselves in responding to the pandemic, underscoring the importance of such partnerships in collectively addressing public health emergencies.

Kudumbashree and community participation

Self-help groups like Kudumbashree play an active role under the corporation and other ULBs. The CDS chairperson noted that while the corporation offers support to Kudumbashree, it primarily operates as a distinct entity within urban contexts. According to the block panchayat president, Kudumbashree doesn't have a direct involvement in health interventions planned by the block or health facility. However, they do engage in various other health-related activities, such as managing vegetable gardens in anganwadi compounds.

During the COVID-19 pandemic, Kudumbashree volunteers played a pivotal role in fostering community engagement at the grassroots level. Additionally, the Haritha Karma Sena, a part of the Kudumbashree network, plays a critical role in sanitation and waste management activities within ULBs. At the municipality level, Kudumbashree initiated a waste management plant in collaboration with the municipality, with 30 members actively participating as green volunteers.

As per the CDS chairperson, Kudumbashree also forms a significant element of participatory platforms such as ward sabha. The role of ASHA workers is pivotal in health-care activities as well as community participation in health. Many of the ASHA workers could eventually build a political career and get elected to governing committees with the trust and experience of community engagement. Let alone Kudumbashree members, the participation of women is observed high in ward sabhas. According to the SC promoter under the municipality, to bring the voice of the SC community into the decisions (as he finds that the SC community are weak in social interaction), a convener from the community is chosen by the community members and they will communicate their needs in ward sabha.

Similar to that of grama sabha in grama panchayats, some of the participants expressed the concern that despite lower

participation, ward sabhas are active when it comes to beneficiary ward sabha but not for developmental discussions or projects. Community participation and participatory governance are the backbones of decentralized governance, but not in the case of ULBs. Urban health facilities within ULBs primarily emphasize curative and palliative care, with the preventive aspect largely centered around sanitation and waste management, despite receiving considerable attention from ULBs. However, beyond these areas, it remains uncertain how effectively urban healthcare facilities can engage with broader public health issues due to infrastructure and funding constraints. Despite some explored settings, the extent of their involvement in addressing public health issues beyond sanitation and waste management remains unclear due to these limitations.

Discussion

The decentralized governance system effectively bolstered rural local governments and their associated health systems. However, in contrast, the urban health sector was deemed weaker in terms of governance and management. This discrepancy is particularly notable given the rapid urbanization of the state, which has presented urban health challenges distinct from those in rural areas.[3] Many of the respondents perceived that low autonomy among ULBs compared to that of grama panchayats contributed to the weaker governance system. The ULBs in Kerala coexist with different power structures and agencies independent of the decentralized governance model. The ULBs have limited control over the health-care facilities and the governance system of the health-care institutions does not work as smoothly as those in the grama panchayats. As per the article by K.C.[6] Sivaramakrishnan, the presence of multiple in-line agencies and state-governed institutions has undermined the authority of ULBs within their jurisdictions. For instance, entities like the Kudumbashree mission and the urban poverty alleviation cell often act as planning agencies for addressing poverty, leaving ULBs with primarily implementation roles.

Kudumbashree is one of the largest women's networks in the world and is dedicated to fostering community participation, poverty eradication, and women empowerment. The many public health activities in urban regions like sanitation and waste management are sustained with the help of this self help group (SHG) network. Although there are many challenges in the urban health-care system and local governance related to that, there are widespread efforts to overcome this with collective action and convergence between different departments. The urban health facilities had to overcome the challenge posed by mushrooming private clinics which also lead to high out-of-pocket expenditure among the rural poor. The introduction of the Aardram mission and initiatives to standardize health institutions are slowly changing this scenario.[7]

As part of the study, we collected secondary data and analyzed the allocation and expenditure of plan funds at the local governments in Kerala from 2014 to 2020. In the case of ULBs, the allocation and expenditure in domains related to health gave out a trend.

From Table 2, it is evident that only half of the overall fund allocated for health and health-related projects in ULBs was utilized from 2014 to 2020. Among the microsectors, the highest utilization is on nutrition, i.e., 75%. The emphasis given to the microsectors such as drinking water, sanitation and waste management, and nutrition is evident in Figure 1. This finding aligns with the themes identified through in-depth interviews. The emphasis on nutrition primarily stems from government mandates regarding the Public Distribution System (PDS) and anganwadi facilities.

Conclusion

The study findings indicate that ULBs prioritize health determinants such as drinking water, sanitation, and nutrition. The allocation of funds to health institutions corroborates the qualitative analysis, suggesting limited ULB involvement in decision-making regarding healthcare activities. Community participation in ULBs is relatively low, resulting in fewer efforts to identify and address health needs among the urban. This study has a major limitation as it couldn't explore the perspectives of the beneficiaries of the mentioned projects or of the community. To tackle the increasing health

Table 2: Overall allocation and expenditure of funds under health-related microsectors by urban local bodies

Sector (2014–2020)	Overall urban allocation	Overall urban expenditure
Total (figure)	9496.5 Cr.	49.09**
Drinking water	27.82*	45.66
Sanitation and waste management	22.62	23.57
Social welfare and social security	15.3	55.45
Health institutions	13.94	55.02
Nutrition	19.17	75
Others	1.15	45.26

*Overall urban allocation - column percentage, **Overall urban expenditure - row percentage

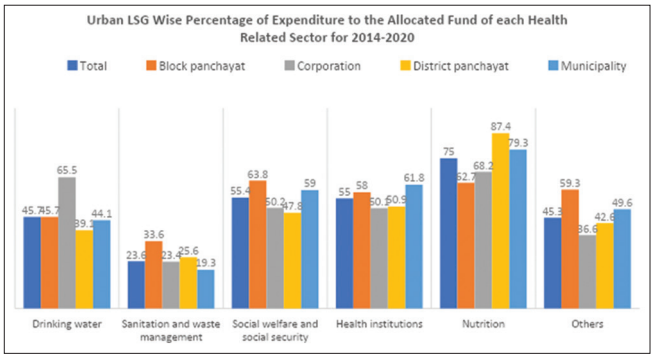

Figure 1: Urban Local Body (ULB)-wise percentage of expenditure to the allocated fund of health-related sectors for 2014–2020.

inequities in urban areas, it is crucial explore this more and enhance community participation in ULBs to improve health governance and financing mechanisms.

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Conflicts of interest

There are no conflicts of interest.

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Original Article

"*Garima* Means to Live with Pride:" A Case Study on Provider Perspectives and Local Government Response to Health of Internal Migrant Laborers in Kerala

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Abstract

Background: Addressing the health needs of interstate migrants in India is a complex challenge. We undertook a case study of *Garima*, a migrant health intervention in Kozhikode district, Kerala, and explored the perspectives of the health system and the role of local governments with regard to the programs targeting the health of migrant laborers in Kerala. **Methods:** We used a qualitative descriptive case study approach as described by Baxter and Jack and used Braun and Clarke's intermediate Q thematic analysis approach. We conducted one key informant interview (KII) and one in-depth interview (IDI) and review of 23 documents obtained from the corporation health department and online sources, including media and social media review. We also did two KIIs with experts and nine IDIs with field workers of the health department of the state. **Results:** Intervention execution was mainly through inspectorial health teams comprising representatives from multiple sectors, including local governments, law enforcement, and health. Actions included registration, screening, disease surveillance, and care provisioning through regular medical camps. Referral and follow-up through regional health-care centers were consistently made available in *Garima*. Migrant health programs increasingly focus on living conditions, including hygiene and sanitation, and employers, contractors, or building owners are to take responsibility for these. **Conclusions:** The *Garima* project for the health of interstate migrant laborers reflected a shift in the Kerala health system toward welfare rather than disease control and intersectoral coordination. Local governments hold the promise of advancing such interventions and scaling them up across the state.

Keywords: Health-care worker, health programs, health system, internal migrants, living conditions

Introduction

Health care for internal migrants in India is a complex issue, particularly highlighted by the COVID-19 pandemic.[1] Migrant workers are often from economically disadvantaged populations.[2] They are often forced to migrate due to inequitable conditions at the place of origin and continue to face inequitable support systems from receiving communities.[3-5] Kerala state in India is a popular destination for internal migrant workers, who come from many other states in India, with a substantial heterogeneity of languages and cultures.[6] About a fifth of the migrant population in 2013 had come in from West Bengal, a state over 2000 kilometers away.[7,8] In India, the central government, state government, and local bodies share the responsibility of the social protection of migrant workers. Migrant welfare interventions, like a temporary ration card scheme in Nashik, Maharashtra, have had limited success. Notable health-specific interventions have been mainly related to the targeted interventions of the National Aids Control Programme as migrants are seen as bridge population for transmission of the human immunodeficiency virus.[9]

Kerala state enjoys a very high human development index with respect to other Indian states, and has decentralized

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governance systems potentially helping the state to work more closely with civil society in critically important sectors such as health care and welfare.[10] Interstate migrant workers may not figure much in this paradigm but have become an inescapable population of interest for all levels of the Kerala health-care system. Studies have reported on the barriers faced by interstate migrant workers in accessing health care in Kerala.[11-13] The health system representation of migrant health-care needs and recent efforts at addressing them, like the *Garima* project of Kozhikode district in Kerala, has been studied to a lesser extent. *Garima*, meaning "a life with pride" in the Bengali language, was an intervention for migrant health in Kozhikode district in North Kerala. In research on health services, qualitative research methods offer the advantage of descriptions of the real-world phenomena with the contexts where they happen.[14] Our study objectives were specifically to describe the evolution and service provisions of *Garima*, the migrant health intervention in Kozhikode district in Kerala, and further to study what field workers of the government health department in Kerala think about how to respond to the health of interstate migrant workers and role of local governments.

Methods

Our study was qualitative in nature, comprising interviews and document reviews. We used a descriptive case study approach where an intervention is described in its real-life context.[15] This case study approach is best suited when the context is important, and the boundaries between the context and the described intervention are not very distinct. We started by describing the evolution of *Garima* and followed up with interviews with other public personnel with varying levels of experience in migrant health. When we use the terms "interstate migrant worker," "migrant worker," or "migrant labourer" frequently in this manuscript, we mean the economically disadvantaged internal migrant worker.

Participant selection

Participant selection was purposive and was part of a larger study on decentralization and health in Kerala and the details of that have been published earlier.[16,17] The study had over 20 subthemes, of which migrant health was one. An arbitrary sample size of 8–10 interviews, comprising 2–3 key informant interviews (KIIs) and 6–8 in-depth interviews (IDIs), was decided upon for this subtheme. We started with the *Garima* scheme for data collection on migrant health issues, and this informed the other interviews done under this theme.

Data collection on *Garima*

We conducted a KII with a senior officer of the relevant health authority in Kozhikode district and obtained copies of official reports of the project. We then conducted one IDI with a Health Inspector, a frontline health worker who was actively engaged in the implementation of the project in their jurisdictional area. We followed up with a media review by a web search of news reports in regional leading newspapers in English for articles with the terms "migrant health" and "Kozhikode." We then added "*Garima*" also as a search term. We also conducted a social media review of Facebook and Twitter posts related to the project. We used the N capture web browser extension to obtain web content from these social media platforms for 2017, 2018, and 2019. We had 16 newspaper reports, 2 social media posts, 1 report with detailed annexures provided by the Kozhikode corporation, 1 report from the Government Nursing College on a medical camp as part of *Garima*, and 3 reports available online on platforms other than newspapers and social media.

Other interviews

We expanded the study to include other public health professionals (two KIIs) and frontline health-care workers (nine IDIs). SB or RPV conducted the interviews virtually after electronically documented informed consent due to the restrictions related to the COVID-19 pandemic. The study was cleared by the Independent Ethics Committee of Health Action by People, Thiruvananthapuram (IEC No EC2/P1/Sep/2020/HAP dated December 10, 2020).

Analysis

For this analysis, we focused on the *Garima* project and the understanding expressed by the providers regarding migrant health. We coded three transcripts inductively. In addition, we used NVivo version 12 to perform automatic coding, sentiment-based coding, and coding based on word frequency.[18] These codes were reviewed for appropriateness, and new codes were added. The media and social media review findings were also coded in this way. Codes were broadly of two types as described by Baxter and Jack (2007) – participant perspectives and views and setting codes. We used the Braun and Clarke method of thematic analysis that combined inductive and deductive processes, categorized as intermediate Q.[19] We made a template with a list of categories emerging from these codes and used it for further analysis through deductive coding. Our approach was primarily descriptive rather than interpretive or constructivist.

Researcher characteristics and reflexivity

RSG was a public health student but was employed as a corporation health officer in Kerala, and this might bring a rationalizing rather than critical perspective to the narrative. However, all other authors were students or professionals of public health or community medicine, bringing in mostly etic perspectives, and the only perspective closer to emic was possibly that of RSG. Furthermore, RSG was the only author focusing exclusively on the *Garima* project. SSB and SG worked on the broader theme of migrant health while all CSD and RPV were involved in the broader decentralization study in some way. We would have missed several nuances and challenges of migrant-specific health interventions as our primary focus was the local government response and also because of our limited experience in public administration and migrant health issues.

Results

Overview of the *Garima* scheme

The scheme was primarily for the assessment and improvement of the living conditions of migrant workers in Kozhikode district. The strategy was for a "squad" comprising members from the field staff of the health department, local self-government department (LSGD), police, and others. The squad would assess living spaces based on eight criteria, as indicated in Table 1 (not a finding of the case study but the list used by the intervention providers). At the time of assessment, a score of one was needed for each item, and a total score of 10 was needed for the establishment to continue functioning. Formal notices with recommendations were given to the owners or employers depending on the extent of the problem, followed by compliance checks and fines/closure if there is no compliance. The program had a multisectoral team monitoring the progress – comprising senior officials from the district administration and relevant sectors, including health and labor.

Garima scheme emergence as understood from media and social media reports

A report on the media and social media review is given in the Appendix. Articles before August 2017 portray migrant issues negatively in terms of health and crime. A major cholera outbreak among migrants in August 2017 was closely followed by the death of a migrant worker after a road accident and denial of treatment in five hospitals. The Chief Minister's formal apology to the family of the deceased following this indicated a change in the approach to migrant health issues, and the term "guest laborers" started gaining traction. Living conditions started getting more attention and the Kozhikode district administration termed it "close to a humanitarian crisis." *Garima* was announced on April 14, 2017, first as a camp and then as inspections of accommodation being provided for migrants. Local Self Government Institutions in Kozhikode were also involved from January 2018 for inspections, "improvement notices," and follow-up. On the basis of inspections so far, the District Medical Officer of Health (DMOH) declared that migrant accommodations "were the worst and a normal human being cannot live in it." The activity ensued in 2018, 2019, and 2020, involving multiple stakeholders such as the Urban Local Body, Labour Department, Government Nursing College, the District Health Department, the Kerala State AIDS Control Society, and the National Health Mission (NHM).

Table 1: Items and ratings of statutory checklist* used in *Garima* project for assessing living conditions of migrant workers

Items	Rating schema
i. Building is registered with Local Self Government Department and there is no waterlogging	Item rating: Very good=3; good=2; average=1; poor=0 Total rating: 18 or above - A grade, 15–17 - B grade, 12–14 - C grade, and below 12 - D grade
ii. Bedroom has carpet area of 2.5 m^2 per person	
iii. Sanitary latrines are available - at least one for ten persons	
iv. Floor is solid, and bathroom is covered	
v. Kitchen in separate room	
vi. Solid waste management facility is available	
vii. Safe drinking water is available	
viii. General hygiene of premises	

*Not a finding of the study, but the items listed were used to indicate the welfare approach of the scheme

Findings from the interviews

Health-care workers perceive their role as facilitating regulatory enforcement for improving living standards, maintaining registers of migrant workers and provision of health care in the form of camps, often accompanied by disease surveillance. The analytical category most commonly coded were "living conditions" with 77 reference points, followed by "disease surveillance" with 55 reference points and "health camp-based approach" with 52 points [Figure 1]. The nodes under disease surveillance and health camp-based approach shared five sources, but nodes under living conditions did not have shared sources with either of the themes – disease surveillance or health camp-based approach. We abstracted our findings under four major themes as described in the following section.

Diversity as a challenge

For the health-care workers, migrant health issues constituted a hybrid terrain of diverse occupations, the type of organization employing migrant laborers, languages spoken, and cultures and practices. Table 2 shows the quotes pertaining to diversity that the health workers have to face. One participant mentioned that migrant workers preferred to group either based on preexisting familial or geographic relationships or based on the contractor who had brought them to Kerala and attributed this to the overcrowding that existed in certain migrant settlements. The health staff mentioned that substance use and a tendency for violence were very high in some settlements and perceived Sunday to be a particularly bad day to visit migrant settlements when they were expected to be under the influence of alcohol or other substances.

Perceived role of health department – camps, surveillance, and hygiene

Medical camps, often including screening activities and surveillance, constituted a central approach for addressing migrant health problems. Most medical camps had the provision for referral to the nearest health center for follow-up care. Mentions of communicable diseases and screening were recurring, but some participants were ambivalent about the extent of the problem. Skin conditions were reported as being extremely common and attributed to overcrowding and lack of hygiene. The quotes pertaining to this theme are listed in Table 2.

Enforcement and registrations

The health system intervened primarily through its inspectorial function of migrant accommodation and punitive action if

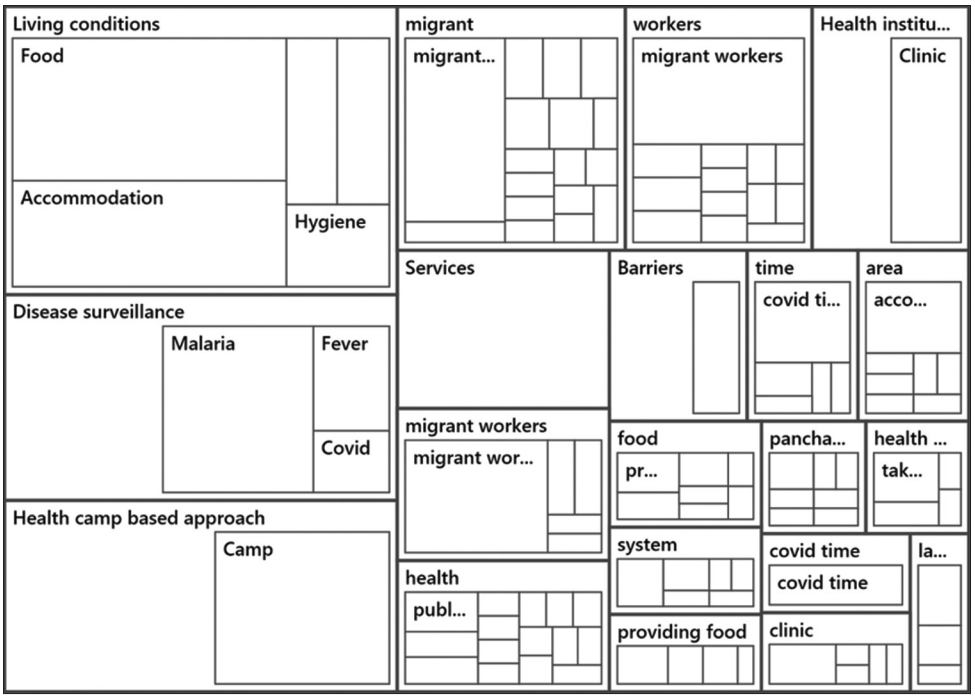

Figure 1: Hierarchy charts of nodes coded under various categories

Table 2: Quotes from the theme diversity as a challenge and perceived roles of health-care workers

Theme	Quote
Diversity as a challenge	I1: …there were about two hundred laborers there, working under different companies and there were so many types of people…If we bring people who know Hindi language in our team, when we reach to the workers they may not know Hindi. They may know Assamese or Oriya
	K3: People who find jobs to do each day… They don't have an employer or a place to live… We call them footloose laborers. They are more vulnerable than others. Similarly… rag pickers…nomadic communities… There are families of nomads on the shores of Kochi backwaters, who make a living by fishing in a basket boat
	K2: We create audio messages (for health) in 10 languages…
Perceived role of health department - surveillance	I5: If the migrant workers report any fever or such cases, we do tests for Malaria and Dengue. For the migrant workers with families, for pregnant women, we conduct their tests and other services in our PHC. Also, we check whether their children have taken the required vaccinations and if not, we provide them vaccination
	I4: We are conducting survey on Malaria, but we are not getting any cases. This year, there is no case of Malaria reported (so far). Last year, there was one case of Malaria…As per our investigation, the migrant workers are having more immunity than us
Perceived role of health department - hygiene	I5: Even though we conduct so many awareness sessions, they will not listen. The level of hygiene is very less for the migrant workers. We faced so many difficulties to convince them

needed. The Ward Health Nutrition and Sanitation Committee that exists in all wards (smallest electoral units) had taken up the inspectorial function also in some places. The regulatory nature is not a new aspect and emerged under the preexisting rubric of the regulatory functions of the health system. The reasons for the involvement of law enforcement were cited as regulatory as well as for the safety of women workers visiting migrant settlements. The enforcement of hygiene is seen as successful by some participants and a futile attempt by others. Table 3 shows the quotes depicting various aspects related to the theme enforcement.

Registration of migrant workers in a health center area was already an established practice. Distribution of identity cards was being practiced in areas with formal migrant health projects. Medical camps were considered to be a convenient location for getting migrants registered into the scheme. The information collection process proved to be of use during the sudden COVID-19 lockdown that was implemented in March 2020. Participants reported that knowing where migrant workers were staying and having some estimate of numbers helped in food distribution and facilitating travel back to their states.

Intersectoral convergence

The administrative system is quite fragmented into several sectors. Migrant health initiatives in Kerala have been characterized by actions that see the sectors frequently converge often right from the planning phase and continue to be so.

K2: "We report to the Kerala Legal Services Authority and the District Legal Services Authority-Ernakulam, District Collectorate, then DMOH and NHM. This is our hierarchical order; and then, on the sides, we are coordinating with the

Table 3: Quotes from categories under the theme enforcements and registrations

Theme/category	Quote
Regulatory nature	K1: "(health authority) has complete right to close down any place or institution if that place is likely to become the cause for spread of disease"
Squads	K1: "In many places, the squad is fully (comprised of) women …migrants workers will not be there at their residence during daytime. The visit will be at night. The (elected representative) may be a woman, all JPHNs (Junior Public Health Nurse) are women, (more than half) of my JHIs (Junior Health Inspector) are women, majority of doctors working in (our department/sister departments) are also women"
Inspections	I3: Since there is monthly visit, there is improvement in the condition of their accommodation and toilets I7: "…for XYZ Company, they will rent a lodge or quarters or big buildings and allocate rooms for them. XYZ, they are having good standards and they allocate only four people in a room. The names of the inmates will be provided on the door of the rooms. XYZ is a group which provides all these things with good standards"
Camps and registration	K1: "A politician who had come to inaugurate a medical camp for migrant workers (and was surprised at the big turnout) said "So many other-state labourers? This is a lottery. Let me call the labour officer." Ever since they (the Labour Department) have a chair at all our camps"

LSGD, then District Labour Officer, Police, Excise, Childline, Anti-Human Trafficking Club… all such groups are there."

Even within the same sector like health, there may be subsectors such as the Urban Local Body, the State Health Department, and the NHM. Such subsectors have come together for migrant interventions consistently over the past few years. Local resource mobilization and public–private partnership models also exist in formal and informal ways on a small scale.

I7: "Various volunteer organizations provided help (in organizing the medical camp). The food was arranged by our Hotel and Restaurant association. Sponsorships were there for the supply of medicines."

Discussion

We attempted a descriptive case study of the *Garima* project of the Kozhikode Corporation, Kerala, and used it to explore the understanding of migrant health issues in Kerala from the health department, mainly at the level of the field workers. The health system in Kerala is moving beyond infectious disease surveillance and control as far as migrant health is concerned. Disease surveillance, proper diagnosis, and treatment of medical problems remain important. A recent screening of interstate migrant workers found 3.8% of them to be positive for the malarial parasite in the blood.[20] However, health is much more than screening and treatment of infectious diseases and biological reasoning has to be integrated with historical, social, and ecological aspects. We further discuss broader issues like the current framing of interstate migrants by the state government in Kerala as guest workers and the regulatory nature of the approach to welfare along with enrollment.

Framing migrant people as guest laborers

The emergence of *Garima* was in the immediate aftermath of a cholera epidemic in Kozhikode in which media attention was the disease. However, the negative attention shifted when a migrant laborer died after a road accident in another part of the state due to the negligence of hospital authorities.[16] We find that the "guest laborer" term became common usage soon after the adverse attention on the state following the negligence event, reflecting active efforts to focus on the welfare of migrants. However, given the diversity of the guest workers and the perceived challenges, the salience of the current framing of interstate migrants as guest workers needs further debate. The term "guest worker" or "guest laborer" reflects the relationship of the migrant worker to nonmigrant people and has connotations for communications, negotiations, and other interactions.[21] "Guest" characterizes a migrant worker as external and temporary and may possibly reinforce the othering of migrant workers.[22] Framing them as guests projects an image of temporary visitors. Our findings suggest that the meanings local residents ascribe to migrants may be influenced by images of migrants that are more likely to get noticed – like crime and substance abuse. Therefore, when these people were already "othered," the term "guest laborer" also claimed to invoke a more positive imagery with an emphasis on the value of hospitality. Frames can be quite powerful in the positioning of issues, policies, and behavior of providers and even people.[23]

Regulatory form of welfarism with enrollment

We find that the shift of focus in the health system toward the welfare of interstate migrant health issues reflected in the *Garima* scheme and other emerging responses of the state was with a distinct regulatory tone. The sectoral convergence across departments such as health, local government, and labor was mainly in the form of participation in the health squad. The visits, checklist-based assessments, formal notifications, and penalties may have possible origins that could be traced back to core legislations of concerned departments that spell out how these departments are to be run. Regarding the regulatory approach, chamberlain pointed out that enactment of any surveillance happens on the disadvantaged populace using health as a justification.[24] The surveillance is expected to be part of a force that encourages self-discipline and correction of aberrant behaviors. Whether persons constitute a risk to themselves or to others needs to be defined, and such definitions are influenced by the neoliberal forces described around production and consumption, resulting in various profiling mechanisms. Local scholars also have pointed out

the problems of implementation of legislative rights of the state when individual legal and constitutional rights of the migrant workers are often neglected.[4] Disciplinary approach to health focus may not be entirely bad, however. Migrant workers are highly vulnerable to exploitation by middlemen in accommodation, employment, and even in making remittances to their families.[6] Exploitation that leads to poor living conditions without access to safe water and sanitation can have several unwanted health consequences. The primary health-care system needs to be aware of the sanitary conditions of the communities they serve. Furthermore, the presence of police in the squads need not always imply fear. A recent study on support of migrant laborers during the COVID-19 lockdown reported the behavior of the government officials and police as "humble."[25]

Our findings reflect the considerable eagerness in the system for enrollment of migrant workers. This has been pointed out as a form of state power – one that migrants have to deal with, in addition to the form of class power that their employers or contractors wield.[26] Again, there is an unavoidability to such a process at some level. A recent assessment of migrant integration policies in India placed Kerala at the top of the chart. Of the eight policy areas the analysis used, Kerala had very high scores in three – (i) identity and registration, (ii) health, and (iii) sanitation.[27] Furthermore, Kerala is the only state that has officially recognized interstate migrant workers as a separate vulnerable category that needs protection in times like natural calamities and other emergencies.[25] Any such categorization and access to the related entitlements usually requires some registration process or else relatively small administrative units like the local self-government unit may get overwhelmed. Documentation processes also bring in some level of accountability to the agency doing the documentation, and also helped in planning of services when the COVID-19 pandemic struck.

Migrants figure in the formal list of vulnerable groups in Kerala. This form of recognition of vulnerability is seldom observed in governments of similar socioeconomic regions.[28] Despite this, there is enormous scope for improvement in the engagement of the state with migrant health issues. One major area that clearly needs more attention is participation of interstate migrant workers in policies and programs meant for their benefit.

Limitations of our study

Our study has several limitations. Electronic interviews were used given the COVID-19-related restrictions. This meant that we were not collecting data within actual physical settings where migrant health issues were being encountered. Our approach to data collection was influenced by our guiding interests that remained decentralization and its role in health system functioning in Kerala. Given these two aspects, our study would not have the necessary rigor of a standalone study on migrant health interventions in the state. Furthermore, given the unique features of the decentralized health system in Kerala, our findings may not be transferable to other health systems. Nevertheless, we believe that the efforts made by the state departments and local governments are worth reporting on at least for the purpose of drawing more research attention to this topic.

Conclusions

The heterogeneity of the migrant populace in Kerala remains a challenge for health workers. While the robustness and sustainability of the interventions we came across are yet to be proven, these interventions have helped to prime the workers of the health department to acknowledge the need to protect and promote the health of this vulnerable group. However, the surveillance-based and regulatory nature of the approach to migrant health reflects the preexisting rubric of the regulatory functions of the health system. The interstate migrant laborers are part of the Kerala community and not merely the builders and cleaners. Refusing to acknowledge the indispensable responsibility, the state and nonmigrant community owe in return to them would reduce them to being mere means to the aspirations of the local populace. Approaches need to be more participatory, respecting the migrant community for what they are a group that survives difficult odds, breaks through many barriers, and humanizes the many disagreeable jobs and spaces in the region.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Appendix

Section 1. Links to media reports and social media posts

Links to media reports and social media posts used for analysis are given below. The first column indicates the alphabetized statements we reported in section 2 of this appendix. The second column indicates the date of the report and the third includes the link/s for the respective statements.

Statement	Date	Link/s
a	March 24, 2017	Philip S. Migrant Workers in Kerala End Up in Jails and Mental Hospitals, The New Indian Express; 2017. Available from: https://indianexpress.com/article/news-archive/web/migrant-workers-in-kerala-end-up-in-jails-and-mental-hospitals/. [Last accessed on 2021 Jun 25]
b	August 3, 2017	Rajiv G. Cholera Alert in Kerala: 3 Cases and 1 Death Reported, The Times of India, Thiruvananthapuram; 2017. Available from: https://timesofindia.indiatimes.com/city/thiruvananthapuram/cholera-alert-in-kerala-3-cases-and-1-death-reported/articleshow/59902844.cms. [Last accessed on 2021 Jun 25]
	August 5, 2017	Anon, Cholera Traced to Migrant Colonies in Kozhikode, Deccan Chronicle; 2017. Available from: https://www.deccanchronicle.com/lifestyle/health-and-wellbeing/050817/cholera-traced-to-migrant-colonies-in-kozhikode.html. [Last accessed on 2021 Jun 25]
	August 7 2017	Chitharanjan S. Cholera Situation under Control and no Need to Panic: DMO, The Times of India, Kozhikode; 2017. Available from: https://timesofindia.indiatimes.com/city/kozhikode/cholera-situation-under-control-and-no-need-to-panic-dmo/articleshow/59959798.cms. [Last accessed on 2021 Jun 25]
	January 11, 2021	Conference Proceedings of 1st International Electronic Conference on Microbiology, 2-30 November 2020. Krishna K, Anas A, Kuttan SP, Vijayakumar S, Chekidhenkuzhiyil J, Philomina B, *et al*. Multiple drug-resistant vibrio cholerae responsible for cholera outbreak among migrant domestic workers in Kerala, South India. Proceedings 2021;66:26. Available from: https://www.mdpi.com/2504-3900/66/1/26/pdf. [Last accessed on 2021 Jun 25]
c	August 7, 2017	Special Correspondent, Turned Back by 7 Hospitals, Victim Dies, The Hindu; 2017. Available from: https://www.thehindu.com/news/national/kerala/turned-back-by-7-hospitals-victim-dies/article19445622.ece. [Last accessed on 2021 Jun 25]
d	August 11, 2017	Collector Kozhikode; 2017. Available from: https://www.facebook.com/CollectorKKD/posts/196642516692758. [Last accessed on 2021 Jun 25]
e	August 13, 2017	Corporation Health Office, Kozhikode, Garima Camp Report, 2017. Personal communication.
f	August 17, 2017	Admin, Mini Townships for the Homeless in Kozhikode Soon, Says Min, Realtyplus; 2017. Available from: https://realtyplusmag.com/mini-townships-for-the-homeless-in-kozhikode-soon-says-min/. [Last accessed on 2021 Jun 25]
	August 18, 2017	Times News Network, Migrants to Get Proper Housing under 'Garima', The Times of India, Kochi; 2017. Available from: https://timesofindia.indiatimes.com/city/kochi/migrants-to-get-proper-housing-under-garima/articleshow/60124179.cms. [Last accessed on 2021 Jun 25]
g	November 20, 2017	Editor, Magic Bricks, Only 1 Out of 163 Rented Houses for Migrants get A Grade in Kozhikode; 2018. Available from: https://content.magicbricks.com/property-news/other-cities/only-1-out-of-163-rented-houses-for-migrants-get-a-grade-in-kozhikode/95740.html. [Last accessed on 2021 Jun 25]
h	January 14, 2018	Times News Network, Survey to Assess Living Conditions of Migrants in Kozhikode, The Times of India, Kozhikode; 2018. Available from: https://timesofindia.indiatimes.com/city/kozhikode/survey-to-assess-living-conditions-of-migrants-in-kozhikode/articleshow/62493468.cms. [Last accessed on 2021 Jun 25]
i	January 19, 2018	Chitharanjan S. Workshop on Jagratha 2018 Project Held in Kozhikode, The Times of India, Kozhikode; 2018. Available from: https://timesofindia.indiatimes.com/city/kozhikode/workshop-on-jagratha-2018-project-held-in-kozhikode/articleshow/62571563.cms. [Last accessed on 2021 Jun 25]
j	January 24, 2018	Express News Service, A Haven for Diseases, The New Indian Express. Kochi; 2018. Available from: https://www.newindianexpress.com/cities/kochi/2018/jan/23/a-haven-for-diseases-1762264.html. [Last accessed on 2021 Jun 25] Staff Reporter, Health Dept on its Toes as a Village Reports 45 Filariasis Cases, The Hindu, Kozhikode; 2018. Available from: https://www.thehindu.com/news/cities/kozhikode/health-dept-on-its-toes-as-a-village-reports-45-filariasis-cases/article22515593.ece. [Last accessed on 2021 Jan 25]
k	February 19, 2018	Staff Reporter, Migrant Labourer with Cholera Symptoms Admitted to MCH, Health Workers under Garima Project Identified Bengal Native During Inspection, The Hindu, Kozhikode; 2018. Available from: https://www.thehindu.com/news/cities/kozhikode/migrant-labourer-with-cholera-symptoms-admitted-to-mch/article22792104.ece. [Last accessed on 2021 Jun 25]
l	February 4, 2019	Staff Reporter, Garima Provides Healing Touch to Migrant Workers, The Hindu, Kozhikode; 2019. Available from: https://www.thehindu.com/news/cities/kozhikode/garima-provides-healing-touch-to-migrant-workers/article26169902.ece. [Last accessed on 2021 Jun 25]
m	May 20, 2019	Jayanth AS. Cholera Puts Migrants Back in Focus, The Hindu, Kozhikode; 2019. Available from: https://www.thehindu.com/news/national/kerala/cholera-cases-put-migrant-labourers-back-in-focus/article27187794.ece. [Last accessed on 2021 Jun 25]
n	November 27, 2019	Staff Reporter, Now, Garima Project Offers Insurance Scheme for Migrants, The Hindu, Kozhikode; 2019. Available from: https://www.thehindu.com/news/cities/kozhikode/now-garima-project-offers-insurance-scheme-for-migrants/article30099706.ece. [Last accessed on 2021 Jun 25]

Contd...

Statement	Date	Link/s
o	January 19, 2020	Staff Reporter, Medical Camp Held for Migrant Workers, The Hindu, Kozhikode; 2020. Available from: https://www.thehindu.com/news/cities/kozhikode/medical-camp-held-for-migrant-workers/article30600878.ece. [Last accessed on 2021 Jun 25]
		Alumni Association of Government College of Nursing Kozhikode, News Report on Health Camp for migrant workers (GARIMA 2020) Jointly organized by Government College of Nursing, Kozhikode and Kozhikode Corporation; 2020. Available from: https://www.facebook.com/watch/?v=2521972344710695. [Last accessed on 2021 Jun 25]
p	May 3, 2020	Staff Reporter, Kozhikode Corporation to Come up With by-Law for Employing Migrants, The Hindu, Kozhikode; 2020. Available from: https://www.thehindu.com/news/cities/kozhikode/kozhikode-corporation-to-come-up-with-by-law-for-employing-migrants/article31494970.ece. [Last accessed on 2021 Jun 25]

Section 2. Summary of performance of the *Garima* scheme as understood from media and social media reports

The links to the reports or posts from which the following chronology has been compiled are given in the previous section.

a. May 24, 2017: Article on migrant workers in Kerala ending up in jail or in mental hospitals
b. August 3–5, 2017: Cholera among Bengali migrant workers in Kozhikode; reports stated that there were 50,000 floating population of migrants in Kozhikode and there were outbreaks earlier in migrants – cholera in 2012 and malaria in 2010. Unsanitary living conditions are also mentioned. Resistance of cholera to all antibiotics except tetracycline alerted the medical community
c. August 7, 2017 – Death of Murugan, a migrant laborer and an accident victim, who was denied treatment in five hospitals, generates a lot of debate. The Chief Minister of the state tenders a formal apology to the family of the deceased
d. August 11, 2017 – District administration of Kozhikode addresses living conditions of migrants as "close to a humanitarian crisis;" announces launch of *Garima* on August 14, 2017, based on the "basic principle of right to live with dignity"
e. August 13, 2017 – A large migrant health camp with involvement of many stakeholders including the Government College of Nursing, Kozhikode, is held at the Corporation Town Hall
f. August 18, 2017 – Press report on *Garima*, a scheme for proper housing for migrants, awaiting approval
g. November 20, 2017 – Only one of 163 *Garima* inspections had received A grade, 23 had received B grade, 68 had received C grade, and 76 had received D grade
h. January 6, 2018 – Call to all local self-government institutions in the district to implement the *Garima* scheme in their jurisdictions and report progress at the review meeting at the District Collectorate; another report on migrant health mentions the following diseases: cholera, TB, filariasis, and sexually transmitted diseases. It also mentions the disparity in numbers reported by different government departments in the district – as per the health department, there were 43000 migrants in the district while the Labour Department had only 7000 registered with them. Those bringing in interstate migrant laborers were expected to register the number with the Labour Department
i. January 14, 2018 – Inspections at sites given "improvement notices"
j. January 19, 2018 – A report citing the District Medical Officer of Health mentioned that of 875 inspections conducted in the district, 341 locations "were the worst and a normal human being cannot live in it"
k. January 24, 2018 – Report of 45 filariasis cases among migrants in one village; active functioning of the Mobile Immigrant Screening Team
l. July 16, 2018 – Official launch of *Garima* scheme for the next financial year in April 2018; implemented by the Department of Health, Local Government, Police, and Excise (administering laws pertaining to controlled substances)
m. February 4, 2019 – Report of *Garima* migrant health camp
n. November 27, 2019 – Report of *Garima* scheme for improvement of living standards, infectious disease screening, and proposed insurance scheme
o. January 29, 2020 – Report on *Garima* medical camp organized jointly by Urban Local Body, Labour department, Government Nursing College, the District Health Department, the Kerala State AIDS Control Society, and the National Health Mission; a news coverage video of this is forwarded on social media on February 24, 2020
p. May 3, 2020 – News article on plan of Kozhikode Corporation to come up with by-law for employing migrants, mentioning the reasonably accurate number of migrant workers that the corporation had, and the protection offered by the corporation for the workers.

Case Report

An Unusually Large Symptomatic Leiomyoma of the Renal Capsule

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Abstract

Leiomyoma of the renal capsule is an extremely rare tumor. Diagnosis is usually made by histopathological examination of surgically removed specimen by partial or radical nephrectomy. We present the case of a 57-year-old female who presented with low backache and right leg pain and on evaluation leiomyoma of renal capsule. It was detected to have unusually large right renal mass mimicking renal cell carcinoma. Radical nephrectomy was done due to large tumor size and histopathology confirmed leiomyoma of the renal capsule.

Keywords: Leiomyoma, mesenchymal tumor, nephrectomy, renal capsule

Introduction

Leiomyoma is a benign mesenchymal tumor, very rarely seen in kidneys, arising from renal capsule or pelvis. It was described first time by Virchow in 1854.[1] Renal leiomyoma is a rare benign tumor with autoptic evidence of 4.2%–5.2%.[2] Because of its rarity and overlapping radiological similarities to renal cell carcinomas, most of the cases undergo partial or radical nephrectomy and diagnosis made only after histopathological examination of surgical specimen. Leiomyomas of the kidney size usually ranges from 0.6 to 7 cm (mean of 2.9 cm) in this case report; we present the case of leiomyoma of the renal capsule in a 57-year-old female who presented with low backache and right leg pain.

Case Report

A 57-year-old unmarried female presented with right-sided leg pain associated with low backache of about 6 months' duration. There were no relevant past history, no urinary symptoms, or hematuria. Ultrasonogram of the abdomen was suggested a large retroperitoneal mass infiltrating right kidney. Magnetic resonance imaging scan abdomen showed right lower pole renal mass of size 10.3 cm × 6.5 cm × 6.3 cm, suggestive of renal cell carcinoma [Figure 1a and b]. Contrast-enhanced computed tomography (CT) scan of the abdomen showed heterogeneously enhancing well-circumscribed right lower pole renal mass infiltrating perinephric fat pad and abutting psoas muscle suggestive of renal cell carcinoma [Figure 1c-f]. The patient was advised surgical excision by partial or radical nephrectomy. Peroperatively, there was a large renal mass about 10 cm × 8 cm involving whole posterior aspect of the kidney [Figure 2a and b]. Hence, radical nephrectomy was done. Gross specimen cut section showed gray white firm whorled neoplasm predominantly in the perinephric fat infiltrating into the kidney measuring size of 10 cm × 8 cm × 8 cm [Figure 2c].

Microscopically, neoplasm showed spindle cells arranged in bundles and fascicles. Cells have elongated cigar-shaped nuclei, fine chromatin, tiny nucleoli, and moderate amount of cytoplasm. Mitotic figures are scanty. Pleomorphism and necrosis are absent. Tumor is seen involving renal capsule and abutting the renal parenchyma. Adjacent renal parenchyma appears normal. Immunohistochemical studies showed H Caldesmon and smooth muscle actin positive, human melanoma black 45 (HMB 45), CD 117, and DOG1 negative suggestive of leiomyoma of the renal capsule [Figure 2d-g].

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The patient was followed up for last 3 months and it was uneventful.

Discussion

Leiomyomas originate from the smooth muscle cells of the renal capsule, pelvis, calices, and blood vessels.[3] Leiomyomas are more common in the uterus. Although it may involve any organ of the genitourinary tract, they most commonly affect the kidneys.[4] In a recent review developed by the J. B. Brady Urological Institute (Baltimore Maryland), in a period over 10 years on 1030 nephrectomies performed, renal leiomyomas represented 1.5% of benign renal tumors and 0.3% of overall tumors treated.[5] Leiomyomas are often detected incidentally. The cases reported in the literature suggest that these tumours affect adult women most frequently. The average age of presentation is 42 years. More than half of the cases present pain and a palpable mass and 20% present hematuria. The patient in this case report had no urinary symptoms or hematuria. Previous report in a 46-year-old woman, intermittent hematuria was reported associated with the renal leiomyoma.[6]

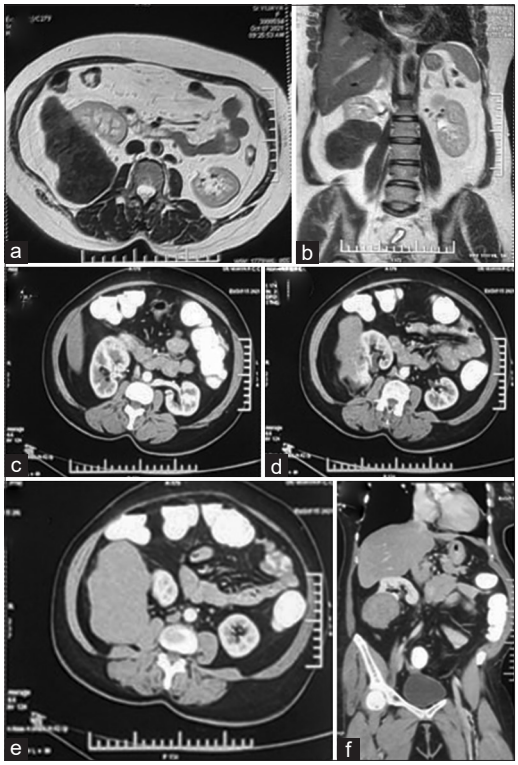

Figure 1: (a and b) Magnetic resonance imaging scan of the abdomen showing right lower pole renal mass of size 10.3 cm × 6.5 cm × 6.3 cm; (c-f) Contrast-enhanced computed tomography scan of the abdomen showing heterogeneously enhancing well-circumscribed right lower pole renal mass infiltrating perinephric fat pad and abutting psoas muscle

Schwannoma, leiomyosarcoma, angiomyolipoma (AML), and solitary fibrous tumor should be considered during the differential diagnosis using histopathology. Positive immunoreactivity for S100 and CD34 was found in Schwannoma and solitary fibrous tumor, respectively.[7] The main differential diagnosis is usually made with AML of the kidney (AML). AML is a benign mesenchymal tumor composed of a variable proportion of adipose tissue, spindle and epithelioid smooth muscle cells, and abnormal thick-walled blood vessels. Most AMLs are composed of a variable mixture of mature fat, thick-walled blood vessels, and smooth muscle, but there are times when only a smooth component is the most represented. AMLs are characterized by a co-expression of melanocytic marker (HMB45) and smooth muscle markers. Focal expression of HMB45 in cortical leiomyomas had a relationship to AMLs and other tumors of the perivascular epithelioid cell family.

The differential diagnosis between leiomyoma and leiomyosarcoma is only histopathological after nephrectomy because the radiological aspect is not diriment in the diagnosis. Ultrasonographic evaluation detects leiomyoma as a hypoechoic lesion that could appear solid or cystic. CT scan features are helpful for the differential diagnosis. The first feature is density. All leiomyomas examined before contrast

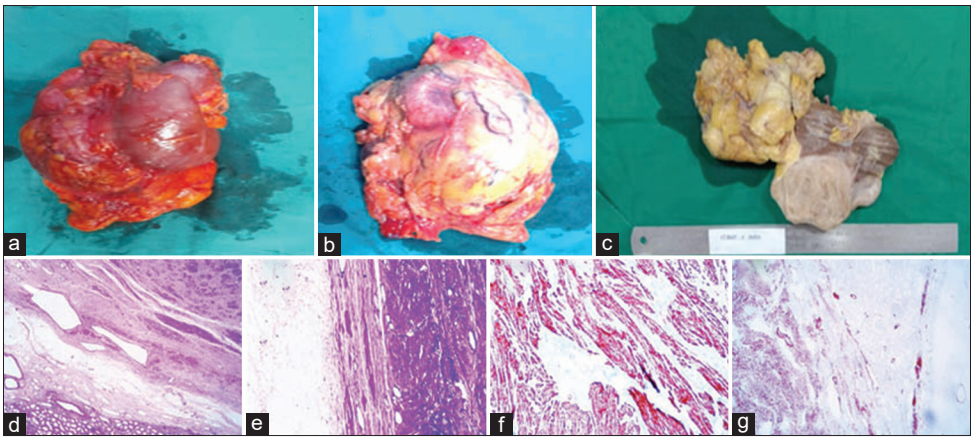

Figure 2: (a and b) Gross specimen of renal mass; (c) Cut section showing gray white firm whorled neoplasm; (d-g) Immunohistochemical studies showed H Caldesmon and smooth muscle actin positive, human melanoma black 45, CD 117 and DOG1 negative suggestive of leiomyoma of renal capsule

were hyperdense compared to the kidney, with density similar to muscles. After contrast medium injection, the lesions had a lower enhancement than surrounding renal parenchyma. The second and final feature is localization and margins. Usually, these lesions have a peripheral location with well-defined margins, with no signs of infiltration into surrounding tissues. In patients with these radiological features, leiomyoma is the part of the differential diagnosis but does not rule out malignant diseases. Surgery remains the gold standard for leiomyoma. In suspicious cases, radical nephrectomy is the typical approach with an excellent prognosis.[4] In cases of small lesions (≤4 cm), it is possible to opt for conservative surgery. Further option for smaller lesions is renal biopsy, although this solution is still controversial.

Conclusion

Renal leiomyomas are benign and not aggressive tumors. They do not metastasize. The prognosis, after surgery, is excellent without recurrence. The differential diagnosis by histological examination is inevitable.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no Conflicts of interest.

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