Risk Assessment of Rheumatic Fever and Mitral Valve Stenosis in Samawah, Iraq

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Abstract

This research was conducted over two years in Samawah, Iraq to determine the spread of rheumatic diseases, particularly mitral stenosis, among children, girls, and adults. Utilizing a digital system, patients were closely monitored, considering factors like age, medical history, and chronic diseases. Through clinical examinations and tests, including pharyngeal swabs and cardiac imaging, effective diagnoses and treatments were administered, with surgical interventions for severe cases. Following international guidelines, the study observed a 97% improvement in 1,200 randomly selected patients, predominantly treated with penicillin derivatives. Notably, children aged 5-15 experienced a 33% decrease in infectious rheumatic diseases, with a 78% improvement in associated conditions. Additionally, cases of rheumatic fever and valve complications saw a 75% improvement, while heart failure and chronic diseases recorded a 65% enhancement. Mitral valve injuries decreased by 82%, with men exhibiting a slightly higher incidence of rheumatic fever. Chronic diseases in both genders were controlled by 70%, supported by a preventive treatment regimen. This underscores the efficacy of early detection and comprehensive treatment in mitigating rheumatic diseases, with collaboration among medical professionals and government support being pivotal for successful outcomes. The study's recommendations emphasize proactive clinical interventions to alleviate the burden of cardiac abnormalities and save lives.

Keywords: Rheumatic fever, Mitral valve stenosis, Streptococcus bacteria, Medical interventions, Public health significance

Introduction

Rheumatic diseases, particularly rheumatic fever, have emerged as a significant public health concern in Samawah, Iraq. This research, conducted from 2022 to 2024 at the Samawah General Teaching Hospital and the Specialized Center for Chronic Diseases and Endocrinology, focuses on the epidemic's impact across various age groups, including children aged 5-15, adult women, men, and the elderly. The frequency of hospital cases due to recurrent infections, particularly mitral valve stenosis, underscores the urgent need to address this issue (Turi, 2022).

The primary causative factor identified is rheumatic fever (RF), linked to streptococcal and staphylococcal bacterial infections (Ross et al., 2010). Several contributing factors were investigated, including population density, economic conditions, genetic predisposition, poverty, environmental pollution, and inadequate healthcare infrastructure, which exacerbate the spread of these infections, especially in less developed areas (Sanchez-Alvarez et al., 2020).

Children, whose immune systems are not fully developed, are particularly vulnerable, leading to severe complications affecting the heart, throat, brain, joints, and skin (McCoyd et al., 2016). This research aims to evaluate the effectiveness of current government

Significance | This study showed that a multidimensional approach involving medical interventions and governmental recommendations can significantly reduce infections and mortality rates, particularly among children, which is important for public health strategies.

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measures, public awareness, and preventive strategies in mitigating the spread of rheumatic diseases. By analyzing patient files, tracking infection patterns, and monitoring intervention measures, the study seeks to identify tangible results and provide recommendations to alleviate patient suffering.

There are various types of microbes, including viruses, bacteria, fungi, and parasites. Bacteria can be classified as either gram-positive or gram-negative（Samaranayake, 2024; Bender et al., 2010）. Gram-positive bacteria are further divided into bacillary (bacilli) and spherical (cocci) forms, with a particular focus on the spherical ones, such as Streptococcus and Staphylococcus. Streptococcus bacteria can be alpha-hemolytic, like Streptococcus pneumoniae, or beta-hemolytic, like Streptococcus pyogenes.

These bacteria enter the body through inhalation, skin contact, or food ingestion, with higher prevalence in children due to their interactions in schools and kindergartens, and in adult males more than females（Moradnejad, 2022）. Streptococcus bacteria have mechanisms to evade the immune system, allowing them to spread and cause infections. They are coated with hyaluronic acid, which protects them from immune cells. Their ability to adhere to patient cells is facilitated by M protein, lipoteichoic acid, and protein F. Streptolysin O breaks down immune cells, while Streptolysin S secretes a toxin harmful to the heart. Exotoxin A causes the rash seen in scarlet fever, and streptokinase destroys the immune network and clots, leading to the development of thrombolysis therapy. Hyaluronic acid also helps these bacteria penetrate cell walls（Prabhakaran et al., 2018）.

When Streptococcus enters the body, it can cause streptococcal pharyngitis, rheumatic fever, rheumatic heart disease, and scarlet fever. The primary concern is the immune complications that arise 3-4 weeks post-infection, including rheumatic fever and acute post-infection glomerulonephritis. Our research focuses on rheumatic fever, which affects the tonsils, joints, heart, and brain, leading to malfunction of the heart valves, especially the mitral valve. The immune system attacks the body's own collagen cells, causing cell death and necrosis (cross-immunity). This is central to our clinical work in monitoring infections affecting heart valves（Shabetai, 2003; Klein & Asher, 2011）.

The normal sizes of heart valves are as follows: atrial valve (5 cm²), aortic valve (3-4 cm²), pulmonary valve (3-4 cm²), and tricuspid valve (7-9 cm²)（Goodman, 1996; Ritter et al., 2023）. Most commonly, cases involve mitral stenosis with occasional mitral regurgitation, particularly among children（Cassidy et al., 1990）. Streptococcus bacteria cause valve narrowing, leading to symptoms like shortness of breath during exercise due to persistent elevation of left atrial pressure and pulmonary venous congestion. Chronic heart disease contributes to these symptoms and can lead to fatigue, atrial fibrillation, pulmonary edema, and tachycardia. Over time, this results in increased pulmonary vascular resistance, high right

ventricular pressure, and heart failure. Patients with mitral stenosis are at risk of left atrial thrombosis and systemic blood clots, which increase mortality rates（Brown et al., 2012; Albrecht et al., 2023; Baumgartner et al., 2022）. This research aimed to develop a comprehensive understanding of rheumatic fever's epidemiology and provide actionable insights to improve patient outcomes and public health strategies in Samawah.

Materials and Methods
Study design:
Patients were selected randomly from those who had been cured with standard antibiotics and did not experience significant complications. Clinically, patients who developed autoimmune rheumatic disease approximately 25 days after initial treatment were distinguished from those who did not. Follow-up focused on these patients, particularly those with a medical history of mitral valve stenosis, who were subsequently treated surgically. The target groups included children aged 5-15 years and girls who were most frequently infected, while monitoring revealed that the infection rate in men was higher than in adult women.

To manage the disease practically, an early digital system was created. This system encompassed clinical examinations, pharyngeal swab tests, bacterial type identification, correct diagnosis, primary and secondary treatment, cardiac echo and Doppler, chest x-rays, and identification of accompanying diseases. Patient documentation included creating files for all patients, which contained awareness materials, guidance, explanatory films, and data on the most prevalent areas.

Various antibiotics were administered with different doses tailored to the age and weight of the patient. The antibiotics used included Augmentin, Azithromycin, Ceftriaxone, penicillin derivatives, long-acting penicillin for need and prevention, non-steroidal and steroidal anti-inflammatory drugs, aspirin, and cardioprotectors. A number of patients with recurrent purulent infections were referred for surgical removal of the tonsils, and patients with late-stage medical histories unresponsive to drug treatment were referred for balloon surgery or mitral valve replacement.

Proactive testing:
Proactive testing was conducted every three months for patients with the highest suspicion and possibility of infection. Specific tests included the ASO Test (Anti-streptolysin), CBC (Complete Blood Count), ECG (Electrocardiogram), WBC Leukocytosis, CRP (C-Reactive Protein) positive, ESR (Erythrocyte Sedimentation Rate) elevation, temperature monitoring (fever), ASO Titre, and Anti-DNase B antibodies. Immune antibodies typically appeared within 1-5 weeks and continued for 6-12 months, disappearing if the disease was successfully treated and resolved.

The reference ranges for ASO test antibodies are as follows: for children younger than 2 years, less than 200 IU/mL; for children

aged 2-5 years, less than 241 IU/mL; and for individuals aged 5-19 years, less than 330 IU/mL. These ranges are crucial for diagnosing rheumatic fever and related conditions. Key terms and acronyms include AV (atrioventricular), HOCM (hypertrophic obstructive cardiomyopathy), HTN (hypertension), IE (infective endocarditis), LV (left ventricular), MI (myocardial infarction), MVP (mitral valve prolapse), RA (rheumatoid arthritis), RV (right ventricular), SAM (systolic anterior motion of the anterior mitral valve leaflet), SLE (systemic lupus erythematosus), and TVP (tricuspid valve prolapse).

Rheumatic Fever Diagnosis and Treatment Strategies:

The diagnosis criteria for rheumatic fever, revised by Thomas Ducten Jouncs, include strategic disease symptoms and treatment plans. The treatment plan is divided into primary prevention, acute rheumatic fever management, and secondary prevention. Primary prevention involves Penicillin V (15 mg/kg/day orally for 10 days), Amoxicillin (50 mg/kg/day orally for 10 days), or a single dose of IM Benzathine penicillin (1,200,000 IU), with a sensitivity skin test being essential. For patients allergic to penicillin, Azithromycin (500 mg/day for 5 days or 12 mg/kg/day for 5 days, maximum 500 mg/dose) is recommended.

For acute rheumatic fever, antibiotics are used to eliminate residual organisms and start secondary prevention, with the same dosages of Benzathine penicillin and Azithromycin as in primary prevention. Arthritis is treated with aspirin (50-60 mg/kg/day, up to 100 mg/kg/day in children, given in four divided doses for two weeks, then tapered for another two weeks) or alternatives like Naproxen and ibuprofen, with stomach protection using PPIs like omeprazole. Carditis is treated with prednisone (1-2 mg/kg/day, up to 80 mg/day, tapered over the last week of therapy) and salicylates (75 mg/kg/day, divided into three doses, continued for 2-4 weeks after stopping steroids). Chorea, erythema marginatum, and subcutaneous nodules are managed with supportive treatments or steroids as needed.

Secondary Prevention Measures:

Secondary prevention involves administering Benzathine penicillin G IM every 3-4 weeks after a skin allergy test. Prophylaxis duration depends on the presence and severity of carditis and residual rheumatic heart disease (RHD): 5 years or until age 21 for those without carditis, 10 years or until age 21 for those with carditis but no residual RHD, 10 years or until age 40 for those with residual RHD, and lifelong prophylaxis for severe residual RHD. For those refusing injections, oral Penicillin V (250 mg twice daily) is less effective, and alternatives for penicillin-allergic patients include Sulfadiazine (1000 mg/day for adults) or Erythromycin (250 mg every 12 hours).

Patient protocols:

The study included 1,300 patients divided into three protocols. Protocol 1 covered 1,200 random cases of males and females of different ages who responded to treatment. Protocol 2 involved 85 cases with symptoms and signs of rheumatic fever, associated injuries, and valve complications like mitral valve injury, regurgitation, stenosis, aortic and tricuspid valve issues, atrial dilatation, arrhythmia, and pulmonary edema. Protocol 3 included 6 cases of patients who developed heart failure and chronic diseases associated with rheumatic fever, particularly in older age groups.

Results and Discussion

The study examined 1,300 patients over two years through a scientific program and cooperative plan with fellow doctors for early diagnosis and treatment of infectious cases. The program utilized recommendations from the Guideline, the American Society, the British Royal College, and government procedures to guide work and technical techniques. Medical files, charts, and tests supported the effort. Of these patients, 1,200 cases were randomly assigned to receive treatment and care with penicillin derivatives, resulting in a 97% improvement rate across seven different areas.

The first protocol targeted children aged 5-15, focusing on multiple injuries, including rheumatic fever (RF) and infectious diseases. This group saw a 33% decrease in RF and accompanying diseases, with 23 cases receiving preventive treatment, leading to a 78% improvement rate. The second protocol addressed RF and infectious diseases in 85 cases, achieving a 75% improvement rate with preventive treatment. The third protocol involved 6 cases of RF and infectious diseases, specifically those suffering from heart failure and chronic diseases. This group experienced a 65% improvement rate, with an 82% decrease in heart valve injuries, primarily affecting the mitral valve (Table 1).

Men exhibited a 7% higher rate of rheumatic fever cases compared to women (Table 2, Table 3). Chronic accompanying diseases in both men and women were controlled at a rate of 70% with preventive treatment for rheumatic fever. The preventive dose of benzathine penicillin (1,200,000 units) was administered every four weeks after an allergy test. The duration of treatment was determined based on age and treatment history, with discontinuation guided by patient response and periodic tests.

Patients with a history of mitral stenosis (±2%) were referred to cardiac surgery, while those with congenital malformations were directed to cardiac surgery from the initial examination with echocardiography. The antibiotic treatments significantly reduced 80% of cases, and chronic heart diseases were controlled, resulting in a 78% decrease. The success of these efforts, with a 75% improvement rate, was attributed to the cooperation of doctors, medical staff, and government procedures, along with concrete recommendations (Figure 3).

Graphical surveys identified the regions most susceptible to infections and infectious diseases at the national level, and health controls were implemented accordingly. Through the efforts of

Table 1. The reasons disease of the valve

| Valve Lesion	main reasons	Incidence rate
Mitral stenosis	Rheumatic fever	± 33%
	Congenital	±2%
	Severe mitral annular calcification	± 1%
	SLE, RA	
		± 00.2%
Mitral regurgitation	Acute	±0.1%
	Endocarditis	±0.1%
	Papillary muscle rupture (post- MI)	± 0.0.0%
	Trauma	± 0.01%
	Chordal rupture/Leaflet flail (MVP, IE)	± 0.01
	Chronic	± 3%
	Myxomatous (MVP)	± 2%
	Rheumatic fever	± 0.1%
	Endocarditis (healed)	±0.1%
	Mitral annular calcification	± 1%
	Congenital (cleft, AV canal)	± 0%
	HOCM with SAM	± 0.1%
	Ischemic (LV remodeling)	± 0.0.1%
	Dilated cardiomyopathy	± 0.01%
Aortic atenosis	Congenital (bicuspid, unicuspid)	±0.01%
	Degenerative calcific	± 0.1%
	Rheumatic fever	±0.01%
Aortic regurgitation	Valvular	± 0.0.01%
	Congenital (bicuspid)	±0.0.0 1%
	Endocarditis	± 0.1%
	Rheumatic fever	± 0.01%
	Myxomatous (prolapse)	± 0.1%
	Traumatic	± 0.0.1%
	Syphilis	± 0.0.0%
	Ankylosing spondylitis	± 0.01%
	Root disease	± 0.0.0%
	Aortic dissection	± 0%
	Cystic medial degeneration 0%	=
	Marfan syndrome 0%	=
	Bicuspid aortic valve 0%	=
	Nonsyndromic familial aneurysm 0%	=
	Aortitis 0.01%	=
	Hypertension 0.5%	=
		=
		=
Tricuspid stenosis	Rheumatic	0.0.01%
	Congenital	0.0.01%
Tricuspid regurgitation	Primary	0%
	Rheumatic	0.01%
	Endocarditis	0.01%
	Myxomatous (TVP)	0.0.01%
	Carcinoid	0%
	Congenital (Ebstein's)	0%
	Trauma	0.0.1%
	Papillary muscle injury (post-MI)	0.001%
	Secondary	
	RV and tricuspid annular dilatation	0%
	Multiple causes of RV enlargement (e.g., long-standing pulmonary HTN)	0.001%
	Chronic RV apical pacing	0%
Pulmonary stenosis	Congenital	0%
	Carcinoid	0%
Pulmonary regurgitation	Valve disease	0%
	Congenital	0.0001%
	Postvalvotomy	0%
	Endocarditis	0.1%
	Annular enlargement	0%
	Pulmonary hypertension	0%
	Idiopathic dilatation	0%
	Marfan syndrome	0%

Table 2. Percent decreased of infection by rates

Clinical Data	Disease progression (RF)	Infectious diseases	Type of Bacteria	Incidence rate
Age (5-15) years	± 63 % down	± 57% down	Streptococcus pyogenes ± 76% **down**	± 67%
	Sore throat and pharyngitis .	± 73% down	Viruses ± 26% down	± 58%
	Arthritis	± 22% down	Cocacia 28% down	± 25%
	Cordites	± 32% down	Fungal ± 12% down	± 24%
	Chorea	---	Parasites ± 4% down	± 6 %
	Erythema	± **3%** down	---	± 3%
	MS, MR	± **70%** down	Streptococcus pyogenes ± 60%	± 65%
	PA, TC	± **75%** down	Streptococcus pyogenes ± 42%	±55%
	Palpitation	± **65%** down	-----	65%
Women	± **46%** down	± **42%** down	± 32% down	± 39%

Table 3. Reducing the semantic plan for men and women

Clinical Data	Disease progression (RF) down	Infectious diseases	Type of Bacteria	Incidence rate
Men	± 22% down	± 23%	Streptococcus pyogenes ± 24%	22%
I.H.D ± 35% down	± 65%	down	down	65%
Hypertension ± 30%	± 60%	down	Viruses ± 8% down	60%
Atrial fibrillation ±33% down	± 30%	down	Fungal ± 10% down	30%
Previous down valvuliplasty±17%	±4	down	Parasites ± 4% down	4%
Diabetic mullets ± 45% down	± 65%	down	down	65%
Coronary artery disease ± 33%	± 70%	down	down	70%
MS, MR 26%	± 9%	down	down	6%
PA, TC + heart failure 6%	± 12%	down	down	8%
Women	± 27%	± 33%	Streptococcus pyogenes ±20%	25%
I.H.D ± 40% down		down	Viruses ± 20% down	40%
Hypertension ± 20% down		down	Fungal ± 7% down	60%
Atrial fibrillation ±23% down		down	Parasites ±2% down	30%
Previous down valvuliplasty±2%		down	down	1%
Diabetic mullets ± 45% down		down	down	30%
Coronary artery disease ± 5% down		down	down	35%
MS, MR 12% down		down	down	4%
PA, TC 2% down		down	down	2%
Heart failur 6% down	down	down		1%

Table 4. The percent spread of the disease and its control in patients according to different protocols

	Ages of patients	Infectious disease	RF+ Accompanying diseases	The amount of improvement
1.	different ages	Healing 1200	±2%	97%
2.	The first protocol - those infected under treatment	Follow-up showed 33% of them under treatment	Follow-up of 23 patients under treatment	79%
3.	Protocol II	Under treatment: 85 patients + accompanying diseases	Healing + preventive treatment	75%
4.	Protocol III	6 patients who appeared in the elderly + chronic diseases under preventive treatment	Preventive treatment with Rheumatic + chronic diseases associated with heart failure	**65%**
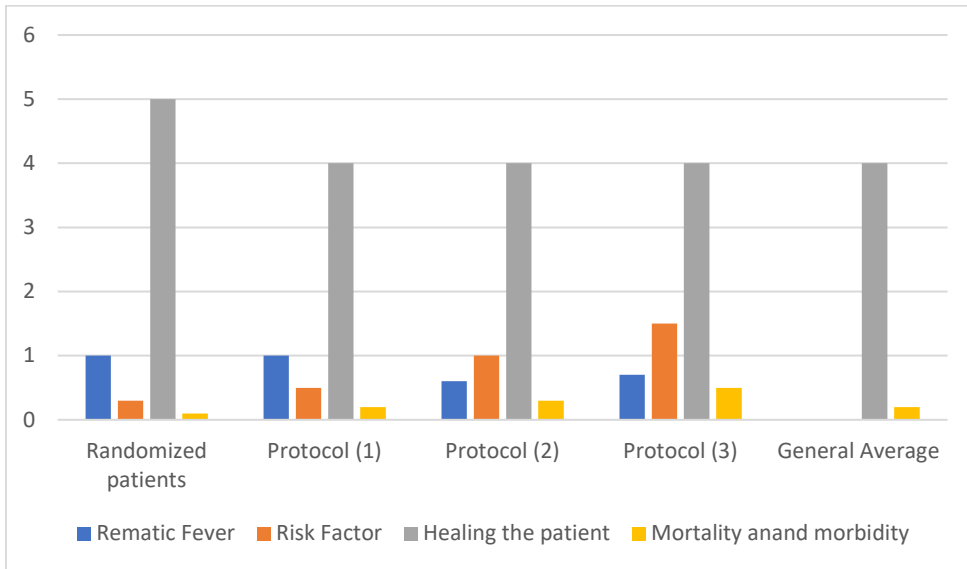
Figure 1. The number of dynamic improvements in the clinical work of Rheumatic Fever

experienced medical staff and a comprehensive treatment plan, the incidence of mitral valve infection decreased by 73% in our cases. Similarly, the aortic valve infection rate decreased by 82%, the tricuspid valve by 85%, and the pulmonary valve by 89%. These reductions were achieved over a two-year period through diligent medical services and interventions.

Out of 1,200 cured cases in a randomized controlled trial, 85 cases were under continuous follow-up and managed effectively. Preventive treatment was administered to 13 patients, and the incidence of other risk factors, including obesity, diabetes, infectious diseases, thyroid and kidney diseases, arrhythmia, psychological disorders, and respiratory diseases, decreased by 78%. Congenital heart valve malformations in children were diagnosed and treated surgically. Among the cases, only 3% involved congenital mitral valve regurgitation, and these patients now lead normal lives without significant health complaints. The overall success of the program underscores the importance of targeted health controls and a well-structured treatment plan in reducing the prevalence and impact of rheumatic heart diseases and associated conditions.

We worked clinically on observing patients, examining the symptoms and signs that appeared, and making real contact with them. The goal was to reduce and eradicate rheumatic disease and all bacteria that infect children and adults. This effort is of great importance to the Samawa region, given its economic and medical conditions, and aims to support poor groups most affected by this epidemic. Rheumatic disease leaves deformities, causes accidents within families, and results in deaths. The research illuminated the defects in medical services provided and government procedures. Additionally, it emphasized the need for citizens to raise their awareness to enhance disease control, despite genetic predispositions and changes in the body's organs upon infection. The disease affects the body's organs, especially the joints, heart valves, nerves, and skin.

Our vision and prognosis aim not just to reduce old infectious and transmissible diseases of developing countries but to highlight the threats to human life. The primary target group is young people. The research sought to identify obstacles, possibilities, and the areas where the disease is most active. The results were successful and did not cause any loss to people, society, or the country. The study will continue to focus on the development of the disease and its resistance. We are committed to finding early and in-depth methods suited to our geographic area and bacterial strains, utilizing modern science and collaborating with American and British medical associations and internationally accredited textbooks. Our study involves continuous periodic review and examination of patients to correct medical management practices. Even patients with old injuries and accompanying chronic diseases had the best chance of receiving appropriate medical or surgical

care and procedures. Consequently, the rate of infections and deaths decreased by 78%.

Conclusion

In conclusion, our study successfully identified the areas most affected by the bacteria causing streptococci in the city of Samawah, Iraq. We focused on rheumatic fever and its impact on heart valves (mitral, aorta, tricuspid, and pulmonary), joints, skin, and the nervous system. Through collaboration with government procedures and the application of a comprehensive early detection system, we gathered data from 1,300 patients to reduce infections, deaths, and heart attacks, especially among children, who are particularly vulnerable.

Our approach included the use of various medications such as penicillin derivatives, non-steroidal anti-inflammatory drugs, steroids, alternatives, cardioprotective medications, and treatments for accompanying and chronic disease conditions. The early digital work and periodic examination schedules distinguished our system, which included disease inventory, laboratory tests, echocardiograms, and chest x-rays. This comprehensive approach resulted in a significant reduction in infections and an impressive recovery rate among the patients.

Specifically, the first protocol targeted children aged 5-15, achieving a 33% decrease in rheumatic fever and infectious diseases, with 78% of patients showing stable improvement. The second protocol addressed adults, both men and women, with accompanying heart diseases and chronic conditions. Out of 85 patients, 75% showed improvement with preventive treatment. The third protocol focused on six patients suffering from heart diseases and heart failure due to age and chronic diseases, achieving a 65% improvement rate. These patients also required follow-up for surgical interventions such as valve replacement and tonsil operations due to repeated suppuration. However, drug treatment was ineffective in 2% of cases with a history of illness.

Our research led to governmental recommendations aimed at identifying critical causes and reforming procedures. The state and government have a major role in eliminating this epidemic, and our study provided a foundation for future efforts to combat streptococcal infections and their severe complications.

We support early intervention to prevent irreversible heart damage. Special care for children includes prevention, early treatment, follow-up, and warfarin administration. Understanding the impact of heart valve replacement on youth is crucial. Mechanical valves are preferred for durability. Clear mechanisms for epidemic control, treatment, and reliable pharmaceuticals are essential. Addressing systemic defects and prioritizing health over conflicts are necessary for progress.

Author contributions

S.A.A.K.O. conducted the experiments, performed the statistical analysis, wrote, edited, and reviewed the article.

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Competing financial interests

The authors have no conflict of interest.

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