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Strategies for Oral Health Research in Africa and the Middle Eastern Region

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Abstract

The highest burden of diseases worldwide is in low- and middle-income countries, but due to lack of capacity and inadequate infrastructure, research output from these countries is unable to address existing and emerging challenges in health care. Oral health research has particularly been hampered by low prioritization, resulting in insufficient development of this sector. There is an urgent need for research correlating oral health to upstream social and environmental determinants and promoting the common risk factor approach for prevention of noncommunicable diseases. Population-wide preventive measures for oral health care are more effective than purely curative approaches, especially for vulnerable groups who have limited access to information and appropriate health care. This article identifies priorities and proposes strategies for researchers, stakeholders, and policy makers for the initiation and sustenance of appropriate oral health care research. The proposed interventions are intended to promote collaboration, capacity building, and health advocacy. Local ownership in multinational research projects in low- and middle-income countries, complemented by skills transfer from high-income countries, is encouraged to ensure that regional health needs are addressed. Emphasis is placed on a shift toward translational research that has a direct impact on oral health care systems.

Keywords: priorities, burden of disease, inequalities, risk factors, primary prevention, health promotion

Introduction

Scientific research in the biomedical and social sciences has led to new concepts and innovations that have had a direct impact on health. These advances in knowledge have not yet benefited developing countries to the extent that they should (World Health Organization [WHO] 2003). There is a global need for research that will generate evidence to develop policies and design programs and interventions that would improve the quality of lives of populations in a cost-effective manner while taking into account the sociocultural and economic context in which people live. An analysis of the research canvas indicates rising health inequalities and inequities among different sectors of the population and an unabated increase in infectious diseases, compounded by the exponential increase in chronic noncommunicable diseases (NCDs). The impact of violence, motor vehicle accidents, and injury—often concomitant with the effects of drug and alcohol abuse—is also a growing concern for the region. Oral health researchers can respond strategically to the emergent needs of Africa and the Middle Eastern region (AMER) by addressing the key challenges identified in the IADR-GOHIRA® Research Agenda: A Call to Action (2013). These include knowledge deficits, an insufficient focus on social policy, separation of oral health from general health, and inadequate evidence-based data.

Only 10% of funding for global health research is allocated to health problems that affect 90% of the world's population (Global Forum for Health Research 2004). In high-income countries within AMER, research expenditure is still a low percentage of gross domestic product due to lack of prioritization (World Bank 2012), while in low- and middle-income countries (LMICs), it is heavily dependent on donor funding (Block and Mills 2003). Currently, large resources are allocated to HIV, tuberculosis, and malaria research (de Jongh et al. 2013). Very few governments in AMER provide adequate funds for conducting health research that addresses other needs, including oral health care. One of the main targets for oral health promotion in the region is integration into general health policies, assimilating it into NCD initiatives through the common risk factor approach. Emphasis in oral health research should focus on broader aspects of primary prevention of shared risk factors rather than curative paradigms. The potential impact of

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this approach on NCDs provides an evidence-based justification for increased prioritization of oral health research.

Countries in AMER exhibit 6 major deficiencies in research capacity (Global Forum for Health Research 2004):

- Low priority for research
- Lack of prioritization of research problems
- Lack of research findings application in policy processes
- Lack of applied knowledge
- Nonoptimal use of human resources
- Issues with monitoring and evaluation of research results

Regional research networks need to be cultivated to address the differences in economic strength, political will, scientific resources and capabilities, and the ability to access global information networks within the AMER. This article provides guidance on research priorities in oral health in AMER, in the context of the Budapest Declaration and the Global Oral Health Inequalities Research Agenda (IADR-GOHIRA), and it examines possible ways in which more resources can be obtained to promote oral health research in the region.

Important Research Priorities

The goal of universal access to health care is far from being achieved almost 40 y after the Alma Ata Declaration in 1978, particularly in the field of oral health where LMICs have been adversely affected by lack of personnel, finances, and infrastructure. The socioeconomic effects of inefficient health care systems are well documented in sub-Saharan Africa. Health research frameworks in the Middle East region have not expanded in tandem with economic development (Kennedy et al. 2008). Morbidity and mortality caused by oral diseases have contributed to reduction of economic productivity within affected communities, further perpetuating the cycle of poverty (WHO 2003). Low socioeconomic status negatively influences the 3 main determinants of health—namely, health behaviors, environmental exposures, and access to care. These combined factors result in higher levels of illness, with the poorest oral health occurring among socially disadvantaged and marginalized people.

A major reason that oral diseases remain a global problem is absence of rational, sustained, interlinked, multitargeted policies directed at proximal causes of dental caries and periodontal disease and the determinants of those causes. Increasing DMFT (decayed, missing, and filled teeth) with age results from dental caries caused by sugars and periodontal disease associated with inadequate oral hygiene and smoking (Thomson et al. 2012; Moynihan and Kelly 2014). The WHO advocates for strengthening of partnerships in resolution WHA 60.17, which urges member states to use evidence-based oral health promotion and disease prevention to consolidate and adapt oral health programs (WHO 2006). One of the overreaching principles in the WHO global action plan for integration of oral health into the framework of NCDs is multisectoral action (WHO 2012).

Oral health care research in AMER should include more intervention research and operational studies to address the social determinants of oral diseases for effective translation of knowledge through oral health promotion and disease prevention into public health programs. It is with this background in mind that the following priority areas have been identified.

Diet/Nutrition and Oral Health

The link between diet/nutrition and oral and general health is well established, and interventions or programs that significantly reduce sugar consumption should be undertaken to provide evidence of best practice. Urbanization and economic development have resulted in widespread nutritional changes in the developing world. Food insecurity resulting from poor agricultural practices and war has caused a shift from traditional eating habits and a decline in the use of natural foods, particularly in LMICs (Bain et al. 2013). Most communities undergoing this nutritional transition do not have adequate exposure to fluoride for caries prevention, and as a result, DMFT indices have been rising steadily (Mobley et al. 2009). In the Arab League, the levels of caries in primary teeth are higher than in permanent teeth (Khan 2014). Provision of dietary guidelines is a key element of the common risk factor approach against NCDs (Watt and Sheiham 2012). The development of intersectoral research linkages and collaborative policies among health, government, food industry, agricultural, and nutrition departments is necessary to ensure that the healthy food choices are the easier choices (Milio 1981) and the latest WHO guideline for the intake of sugars is adhered to (WHO 2014).

National policies addressing the socioeconomic determinants of malnutrition need to be informed by targeted research activities. Research is needed to:

- identify segments of the population that are at high risk for dental caries;
- investigate different behavioral change approaches that promote reduction of the intake of sugar-sweetened beverages and determine thresholds above which the consumption of free sugars increases the risk of unhealthy weight gain, obesity, and other related NCDs (WHO 2014); and
- conduct cohort studies with improved methodology for assessing dietary intake in areas with and without fluoride, with quality data related to the link between sugar consumption and dental caries and its economic costs.

Pitts et al. (2011) outlined a 5-y research agenda related to dental caries that included the recommendation to translate existing and new research into clinical and public health practice by defining 1) valid and efficient research methods for demonstrating caries arrest and assessing the remineralization potential of potential agents and 2) ways to ensure that research findings about remineralization and new biofilm-based methods of effective caries control can be transferred more efficiently and rapidly into routine clinical therapy and practice. This research agenda

should be implemented in AMER, taking into account availability of resources and required infrastructure.

Tobacco Use and Oral Health

Tobacco use has continued to increase in AMER, especially among adolescents and women. Unless urgent action is taken, the annual death toll associated with tobacco use will rise to more than 8 million by 2030, and 70% of global deaths from tobacco will occur in LMICs (Gajalakshmi et al. 2000). Tobacco use has significant adverse effects on oral and general health. Its oral effects vary from altered smell and taste sensation to dental staining, periodontitis, and oral cancer.

Although most AMER countries have complied with tobacco control laws as recommended by the WHO Framework Convention on Tobacco Control, there is insufficient involvement of health workers in smoking prevention and cessation. This may be attributed to the lack of policies for the integration of tobacco cessation and control in the training of health workers (Ali et al. 2012). Global research has shown that oral health care workers with tobacco cessation training perform more interventions, report increased self-efficacy and fewer barriers, and register higher levels of acceptability than do those without training (Gonseth 2010). In the context of increasing tobacco use in LMICs, there is urgent need for research to develop appropriate modalities of promoting abstinence and ceasing tobacco use.

HIV/AIDS and Oral Health

As the number of people living with HIV/AIDS continues to increase in AMER, emerging epidemics need to be addressed, and health care providers in many countries where the disease burden is still high need to be prepared to meet the specific needs of managing the morbidities associated with the infection (Mumtaz et al. 2014). Oral manifestations of HIV continue to be relevant in the post–highly active antiretroviral therapy era. They play a key role in defining the natural history of immune deterioration. The recurrence of oral diseases such as candidiasis among people living with HIV/AIDS on highly active antiretroviral therapy may serve as markers of noncompliance and/or viral resistance.

Opportunistic infections and neoplasms will increasingly affect the craniofacial tissues of 40% to 50% of antiretroviral-naïve patients as CD4/CD8 ratios decrease (Frisch et al. 2001). Low saliva production increases the risk of developing caries, and continuing research suggests that salivary mucoceles occur more frequently in immune-suppressed patients (Kamulegeya and Okello 2012). New research areas need to include updated epidemiologic and surveillance data, cost-analysis studies, effectiveness data of individual interventions and programs (Challacombe et al. 2011), and treatment of oral manifestations of HIV/AIDS. Efforts to document the epidemiologic and pathologic evolution of HIV need to be centered in countries that carry the greatest burden of disease but have the lowest capacities in health care to do so.

Psychosocial Implications of Oral Disease

Health is defined as the sum total of a person's physical, mental, and social well-being and not merely the absence of disease or infirmity. Full assessment of this health triad is a central tenet of general and oral health–related quality of life (WHO 2006). Current research has shown that in addition to finances and environment, a person's knowledge, attitudes, subjective norms, and perceptions affect his or her treatment-seeking behavior (Rozier and Pahel 2008). Oral health perception and impact on quality of life require testing within regional sociocultural contexts, with adaptation of survey instruments to account for different languages and social norms. Information on the effects of poor oral health on everyday activities and economic productivity will contribute to the evidence base for oral health promotion and enhance translational research.

Research into Development of a New Model for Oral Health Promotion

New models for oral health promotion consider oral health to be an integral part of general health, addressing needs and demands of populations through an integrated upstream public health approach, thereby moving health from an individual lifestyle/choice model to one that tackles the social determinants of chronic diseases (Glick et al. 2012). If behaviors are to change, the environment disposing people to adopt health-compromising behaviors must be addressed. Health promotion to improve social and physical environments supportive of health is pivotal to improving health and should redress the balance of influences toward making healthier choices easier (Milio 1981). Therefore, research on oral health promotion in different settings should be conducted and evaluated.

Oral Hygiene and Periodontitis

Suboptimal oral hygiene remains the most common etiologic factor in the occurrence and progression of chronic periodontitis (Morgano et al. 2010; Kolawole et al. 2011; Gathecha et al. 2012). Recent findings have linked periodontal disease to a myriad of systemic diseases, including cardiovascular diseases, diabetes, preterm low birth weights, and rheumatoid arthritis (Wandera et al. 2012; Jeftha and Holmes 2013; Chee et al. 2013). A number of candidate protein biomarkers have the capacity to be useful for staging of periodontal damage and, by extension, assessment of NCDs (Guzman et al. 2014). The development of sensitive salivary biomarkers for identification of high-risk individuals will facilitate periodontal screening, early diagnosis, and timely treatment.

Cancrum oris (noma) is a form of gangrenous stomatitis that has been eradicated in many parts of the world but still occurs in Africa. It is etiologically associated with malnutrition, childhood diseases, and necrotizing gingivitis—conditions that are synonymous with poverty (Enwonwu et al. 2006). If diagnosed early, it responds well to antibiotic treatment and curettage of the gangrenous tissues.

Control of periodontal diseases is particularly amenable to preventive approaches, and multicenter longitudinal research on establishing effective oral health care programs for prevention of periodontal diseases are required (Jin et al. 2011). Many people in AMER use the chewing stick (also known as *miswak*) for cleaning their teeth. The chewing stick has been shown to exhibit antimicrobial properties and benefits to periodontal health (Akpata and Akinrimisi 1977; Taiwo et al. 1999). Clinical trials are needed to determine the most efficacious technique for its use.

Traumatic Dental Injuries

The main causes of dental trauma in adults are road traffic injuries and interpersonal violence (Fakhruddin and Kawas 2010; Ajayi et al. 2012), whereas in children, damage to the teeth is a consequence of falls and infant oral mutilation (Kamulegeya et al. 2009; Naidoo et al. 2009). The exponential increase in the use of motorized transport, ongoing violence, and the proliferation of armaments in the region requires adequate responses from the health sector and political goodwill from governments to enforce safety regulations to reduce injury and preserve life. Traumatic dental injuries have been shown to be associated with geography, socioeconomic trends, traffic legislation, and seasons. Further research is required to fully describe the types, severity, and risk factors for traumatic dental injuries to formulate effective prevention strategies (Oginni et al. 2009).

Oral Cancer

Cancers of the oropharynx, hypopharynx, and upper digestive tract affect contiguous anatomic sites and share common etiologies. When age-standardized incidence rates are combined, this group of neoplasms features among the top 3 malignancies in the region (Globocan 2008). Risk factors for oral and pharyngeal cancers include tobacco use, betel quid chewing, alcohol consumption, human papillomavirus infection, sunlight exposure, and poor nutrition (Petersen 2009b). Although the strongest attributable risk factors for development of oral cancer are tobacco and alcohol, human papillomavirus 16 and 18 are consistently associated with cancers of the oropharynx and posterior tongue. Emerging data on orogenital concordance of human papillomavirus infection should provoke a debate on combined strategies against cancers in these 2 sites (Beder Ribeiro et al. 2014). The diversity of risk factors contributing to high incidences of cancers of the head and neck in LMICs is yet to be documented. Multidisciplinary research partnerships are further needed to the poor prognosis of oral cancer (Johnson et al. 2011).

Oral Health and Fluorides

Exposure to appropriate levels of fluoride has been shown to be one of the most effective methods of caries control (WHO 2006). As many disadvantaged communities have no access to piped water (Akpata et al. 2009), suitable alternative methods for fluoride delivery need to be established for populations at high risk for dental caries. Similarly, in countries that have access to potable water but still have high caries experience, it will also be necessary to determine the appropriate level of fluoride exposure (Al Dosari et al. 2010). Geologic differences within AMER creates the need for establishment of guidelines for community water defluoridation integrated into safe water campaigns.

Given the fact that fluoride toothpaste remains the most widespread form of fluoride application, used worldwide for the reduction and control of dental caries, it is essential that fluoride toothpastes contain the correct amount of free available fluoride that assures their effectiveness. Studies on the quality of fluoride dentifrices sold in African countries show that quality control at a national level is poor. The free fluoride concentrations in toothpastes are frequently inaccurate and well below levels required for caries prevention (Ndiokwelu and Zohoori 2010; Benzian et al. 2012). Research is required to determine appropriate global international standards to determine what constitutes effective fluoride toothpaste.

Dental Materials

Dental amalgam is still widely used in LMICs. Three East African countries are currently involved in a country-level demonstration project promoting the "phase down" approach to reduce use of dental amalgam (United Nations Environment Programme et al. 2012), but it is still in wide use for restoration in stress-bearing areas in many countries (Burke et al. 2003). Tooth-colored restorative materials with the potential to replace amalgam are available, but research on their quality and clinical performance is urgently needed. A focus on climatic factors in relation to the longevity and handling of dental materials is also needed to elucidate the differences between the tropical countries and temperate countries where most dental materials are researched and manufactured.

Oral Health Information Systems

Capacity building in health information systems is imperative for achieving the Millennium Development Goals (Nuyens 2005). Policy makers and health care professionals require the tools, competence, and information to calibrate their health systems according to the population needs (Lansang and Dennis 2004). Development of evidence-based solutions for oral health remains a challenge in AMER, where disease surveillance systems are generally underdeveloped and research capacity is low (Minja et al. 2011).

Given the widespread failure of conventional data capture systems, such as cancer registries and national surveys in the region, research networks and the adoption of the community-of-practice initiative may bridge the defects in our health systems. A community of practice is a common interest group in which an interdisciplinary team of professionals, policy makers, ethicists, and community representatives work together to enhance

knowledge management and clinical practice. Communities of practice are an innovative means of data capture, transfer of information, and archiving of knowledge in environments where institutions are either absent or underdeveloped (Fitzgerald and Dopson 2006). Research consortia linking institutions within and outside the region are the future networks that will provide information for disease registries and designing of national surveys. With increasing Internet coverage and mobile phone technology, virtual research institutions are a realistic solution to geographical inaccessibility.

Oral Health Policy and Health Systems Research

The WHO global policy for the improvement of oral health recognizes that the development of evidence-based strategies requires consideration of the burden of oral diseases in terms of pain, loss of function, compromised nutrition, and diminished quality of life. A renewed focus on population-based campaigns for oral health promotion and disease prevention is essential in AMER to reduce the dependence on curative paradigms that have thus far proven to be ineffective and financially unsustainable (Petersen 2009a). The failure of oral health policy in developing countries is arguably due to the arbitrary development of health care systems in the absence of research to provide a sound accessible evidence base (Pang and Terry 2011).

Efforts to address oral health inequalities must therefore be built on a foundation that links policy, research, and science. Emphasis must shift from what is largely basic biomedical and clinical research to community-based determinants of health research (Sheiham et al. 2011). In addition, Sheiham et al. (2011) suggested that to strengthen health systems, strategies for research should focus on 1) policy changes to enhance prevention, 2) provider education consistent with this objective, 3) incentives inherent in financing mechanisms to sustain such service provisions, and 4) self-care incentives to reduce disease and promote health.

The lack of a global framework that safeguards oral health as a fundamental human right is a call to action for stakeholders at levels both national and international (Lee and Divaris 2014). While the need for more health systems research and inter- and multisectoral approaches to science, technology, and health have been recognized (WHO 2008), the challenges of implementation for LMICs with their fragile health systems and poor health research capacities urgently need to be addressed (Ijsselmuiden et al. 2012).

Research Policies for Oral Health Research

Collaboration among researchers, stakeholders, and policy makers is critical to increase the impact of research on oral health systems. There is an urgent need for comprehensive and rigorously conducted impact evaluations documenting the entire health causal chain, spanning funding to program scale-up to outputs, outcomes, and impacts, with clear indicators of system responsiveness (Rispel et al. 2009). Many AMER countries have environments that are not conducive to carrying out research: legislative frameworks have not kept abreast with new aspects of research, such as genetics, clinical trials, material exchanges, biobanking, and intellectual property rights (Whitworth et al. 2008). Global oral health also suffers from a lack of analysis, connection, and insight into political contexts (Benzian et al. 2011), further compounded by the fact that few countries have fully operational national health research programs or appropriate policies and institutions to formulate relevant national health research programs (Pang et al. 2003).

Health Research Capacity Requirements

In most countries in AMER, conditions for carrying out research have been severely compromised by the generally poor remuneration, heavy teaching loads, inability to mentor young faculty, and inadequate infrastructure (Sawyerr 2004; Kennedy et al. 2008). Currently, professional dental training retains its emphasis on treatment-based learning and, as such, does not provide for adequate preparation to carry out in-depth biomedical research (Holman et al. 2014). While health research capacity has grown considerably in the region and successful capacity development programs led by local researchers have started to emerge (Zumla et al. 2010), many collaborations are hampered by the practice of extractive research where data or samples are transported to a high-income country, with little benefit to the LMICs (Chu et al. 2014). Kellerman et al. (2012) reported that investing in institutions to improve research training capacity resulted in the retention of graduates and increased research outputs. However, there remains a dire need for the development of human and physical health research capacity to strengthen the strategies for oral health care delivery in the region and to ensure that research is recognized as the foundation for oral health policy.

Conclusions

Identifying critical gaps in knowledge and setting oral health research priorities is the first step of implementing the IADR-GOHIRA Action Plan (2013) in AMER. Broad consultation with policy makers and researchers in the region in setting research priorities for AMER has laid the groundwork for developing a regional knowledge base. Local coordination and oversight of multinational research projects are encouraged to ensure mutual and equitable benefits to partners in prioritization of regional health needs, skills transfer, and authorship equity in publication planning (Chu et al. 2014). Integration of oral health into general health programs is a priority outcome of the IADR-GOHIRA initiative and encourages a renewed focus on an upstream public health approach, moving health from an individual lifestyle/choice model to one that tackles the social determinants of chronic diseases (Milio 1981; Glick et al. 2012).

The Global Oral Health Inequalities Research Agenda (IADR-GOHIRA) network should be used as a platform for advocacy toward legislative reforms and funding to improve and facilitate environments conducive for research (Whitworth et al. 2008).

Author Contributions

S. Naidoo, contributed to conception, design, acquisition, analysis, and interpretation, drafted and critically revised the manuscript; E. Dimba, contributed to data acquisition and interpretation, critically revised the manuscript; V. Yengopal, M.O. Folayan, E.S. Akpata, contributed to data acquisition, critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work.

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