

# Genetics in Oral Health: The Need for Human Genetics in the Dentistry Curriculum.



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## ABSTRACT

### Introduction

Genetic and genomic research has improved understanding of the genetic origins of growth, development and disease. Dentists may encounter genetic disorders or oral manifestations of a genetic-based systemic disease, and need to have a sound understanding of genetics if accurate information is to be given to patients. No known studies that have evaluated the option of an undergraduate course in genetics.

### Aim

To establish this need at the University of the Western Cape, South Africa.

### Methodology

A cross-sectional, observational survey was conducted in 2017.

### Results

Ninety-seven dental students and 21 staff members participated. All knew that genetics was not included in the undergraduate dental programme; 13% knew that there had been no course in the past; 34% felt confident in their knowledge; 29% were ill-equipped to communicate with other medical clinicians about genetic disorders; 77% of all participants expressed the need for genetics education in dentistry.

### Conclusion

There is a significant lack of knowledge and confidence of both staff and students to treat patients with genetic conditions. A formalized course in human genetics should be incorporated into the dental curriculum at the Dental Schools in South Africa.

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## INTRODUCTION

Genes are what constitute the human genome. They determine the characteristics of individuals and are transferred from one generation to the next. The human genome project, published in 2001, is considered the most important scientific accomplishment in history.<sup>1</sup> The information emanating from this project led to an understanding of the role of genetics in the aetiology of several diseases and disorders. Mutations in the genome results in genetic conditions, many of which are heritable. Phenotypic expression of genetic aberrations can affect any tissue or organ including those in the head and neck. There are approximately 5,500 known inherited diseases in humans and more than 700 involve craniofacial malformations (www.nidcr.nih, 2017). According to Smith's Recognizable Patterns of Human Malformation, 12 of the 26 categories of malformations used for diagnostic purposes involve features of the head or neck and several are limited to oral structures.<sup>2</sup> The influence of genes in the development of oral disorders, including dental caries, periodontal disease and malignancies of the oral cavity is becoming apparent. Likewise, the effects of genetic diseases on oral structures are becoming evident.

In order to discuss the genetic factors and the impact of genetic disorders in oral health care and to manage and treat patients appropriately, it is important for dental clinicians to have a comprehensive knowledge of genetics. A sound understanding of genetic susceptibility, lifestyle, and oral health risk factors allows the dentist to offer effective preventive and treatment strategies for oral diseases. An understanding of the molecular biology of bone, periodontal structures, salivary gland, and tooth development could lead to innovative treatment approaches that may differ from dentistry's current surgically based techniques. Tissue engineering in terms cell manipulation such as the development tissue such as skin, bones, and cartilage has already been explored. Advances in drug delivery, gene therapy, and biopharmaceuticals are creating new therapeutic methods that vastly differ from those currently in practice.<sup>3</sup>

The foundations of academic and clinical dental practices are embedded into the undergraduate dental curriculum. The introduction of genetics education during the formative phases of training will have a significant influence on the incorporation of this field into oral health care. Consequently, dental graduates will be equipped with a basic knowledge of genetics and skills for understanding and applying this to clinical practice. Foundational compulsory skills in genetics for all health care professions have been established in the United States of America.<sup>4</sup> In South Africa, however, the core knowledge in this field remains underdeveloped for dental professionals.

In view of the expanding interest in genetics and its application in oral health and disease, the authors conducted a questionnaire-based survey of senior undergraduate and postgraduate dental students and staff members at the Faculty of Dentistry, the University of the Western Cape, South Africa. The main purpose

of the investigation was to assess the need for human genetics and genomics in the dental curriculum at the University of the Western Cape. The objectives were to determine:

- Whether there is an established genetics course for undergraduate and postgraduate students,
- The current status of human genetics and genomics in the dental curriculum at the University of the Western Cape,
- The manner in which genetic concepts are integrated into various courses at the Faculty of Dentistry,
- The perceived need for genetic education into the dental curriculum.

## METHODOLOGY

### Study Design

This study was a cross-sectional, observational study in the form of a survey and was conducted between July 2017 and October 2017. It enabled the researchers to analyze various factors simultaneously and was conducted for health planning and curricula purposes. Ten undergraduate dental students interviewed the participants on separate occasions.

### Study Population

The research population included the part-time and full-time academic staff, 4th and 5th-year undergraduate dental students and postgraduate dental students at the Faculty of Dentistry, the University of the Western Cape, Tygerberg Oral Health Care Centre.

### Generalizability

This study is applicable, but not limited to, the UWC Faculty of Dentistry. The results of this study would be practical and relevant to all dental schools in South Africa.

### Sample Size:

A total of 118 individuals participated.

The following tools were used:

- A questionnaire
- Excel spreadsheet for the capture of data
- Epi-info to analyse the data

The survey form contained 14 individual questions specifically constructed to determine the participants' awareness of the dental curriculum and the clinical relevance of genetics in dentistry. None of the questions was open-ended.

### Validity

Validity was obtained to eliminate bias.

### Logistics

Each group member presented the questionnaire to participants. The data were collected and collated and into an Excel spreadsheet and made suitable for statistical analysis.

### Ethical consideration

Ethical clearance was obtained from the University of the Western Cape's ethical committee. This study was conducted in accordance with the guidelines of the Declaration of Helsinki. There was no conflict of interest. Informed consent was obtained from all participants and full disclosure of the purpose, methods, alternatives, associated risks and benefits were verbally conveyed to each participant prior to conducting the questionnaire. The consent form was read in one of three of the predominant official languages spoken in the region. Participant confidentiality was maintained throughout the study. Participation was voluntary and could be withdrawn during any phase of the investigation. All participants will be informed of the outcome of the study post completion.

## RESULTS

The total number of participants was 118 of whom 97 were students and 21 were academic staff from the UWC Dental School.

All participants knew that a formal background of genetics was not a prerequisite to enter the dental school.

Figure 1 shows the percentages for the various answers for different categories of participants (i.e. 'staff', 'students' and 'staff+student') pertaining to the genetics course. About 61% of all participants ('staff+student') did not know whether there had been a genetics course in the past at the Faculty of Dentistry. Twenty-three percent (23%) were unable to answer the question while 13% said there was not a course and only 2% affirmed there was a genetics course in the past.

Figure 2 shows the percentages of different genetic disorders reported by participants as being common at the Dental Faculty for different categories of participants. Cleft palate and Down's syndrome were documented as the most common disorders (36% and 35% respectively). The frequency of these genetic disorders was followed by Amelogenesis imperfecta (17%), Dentinogenesis imperfecta (9%) and Ectodermal dysplasia (2%) in that order. Thirty-nine percent of academic staff suggested Cleft palate as the most common disorder, while the frequency of Down's syndrome and Amelogenesis imperfecta were equally suggested by 25% of the staff. Conversely, 46% of students suggested Down's syndrome was the most common disorder followed by Cleft palate (33%), Amelogenesis imperfecta (9%) and Dentinogenesis imperfecta (8%).

Figure 3 shows the percentages of the answers for the different categories of participants with reference to the ability of dental clinicians to treat patients with genetic abnormalities on their own. Thirty-nine percent of all the participants could not provide an answer to this question. Of the remaining 61%, only 34% of the participants felt confident to treat patients with genetic abnormalities compared with 27% who did not. This percentage ranking for all participants is further supported by the staff and student categories. Overall, approximately 30% of all participants acknowledged that dental clinicians are able to treat patients with genetic abnormalities on their own while 70% felt otherwise.

Figure 4 shows the percentages of the various answers pertaining to the different categories of participants concerning their ability to communicate with other medical clinicians about genetic abnormalities. The histograms revealed that an overall of 60% of all participants was confident that they could communicate with other clinicians. However, there was a disparity between the percentages of staff and students (71% and 49% staff and students respectively). Moreover, 29% of students felt ill-equipped to communicate with other medical clinicians and 22% of students did not answer the questions.

Figure 5 shows the percentages for the various answers for different category of participants pertaining to their knowledge in recognizing genetic abnormalities in dentistry. The data show that 32% of all participants felt that they had the necessary knowledge, 35% stated they did not have the necessary knowledge and 30% did not know whether they had knowledge adequate to recognize genetic abnormalities in dentistry.

Figure 6 shows the percentages for different categories of participants to assess the standard of knowledge in genetic disorders in dentistry. Only 10% of all the participants feel that their level of knowledge is good which suggests that there is insufficient knowledge in genetic disorders. This is also an indication of the need for such a course at the Dental school.

Eighty percent of all participants rated the specified conditions as important in dentistry.

The percentages of different participant categories rating the importance of individual dental condition are shown in Figures 9 to 11. More than 90% of all participants regarded Osteogenesis imperfecta Type 3 and Cleft palate as important dental conditions (Figures 8 and 9). Greater than 70% of all participants rated periodontal disease as an important dental condition compared with 22% of students who considered it as unimportant (Figure, 10). Fifty-four percent of all participants rated Dental caries to be important in dentistry compared with 46% who considered it unimportant.