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**Comparison of early effects of *S. pneumoniae* vaccination
policies on nasopharyngeal carriage in a Palestinian
population**

Mahmoud Ahmad Mohammad Ramlawi

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Comparison of early effects of *S.pneumoniae* vaccination policies on nasopharyngeal carriage in a Palestinian population

Prepared By:

Mahmoud Ahmad Mohammad Ramlawi

**B. Sc. in Medical Laboratory Sciences–Al-Quds University
Palestine**

Supervisor: Dr. Kifaya Azmi

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Prepared By: Mahmoud Ahmad Mohammad Ramlawi

Registration No: 21511200

Supervisor: Dr. Kifaya Azmi

Master thesis submitted and accepted 21/04/2019

The names and signatures of the examining committee members are as follows:

1- Head of Committee: Dr. Kifaya Azmi

Signature : 

2- Internal Examiner : Dr. Omar Hamarsheh

Signature : 

3- External Examiner: Dr. Mahmoud Srour

Signature : 

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Dedication

To my almighty God, who gave me strength and knowledge
through my life.

To Dr. Kifaya the great teacher and the exceptional human.

To my father who inspired me to be strong despite all the ob-
stacles.

To my mother for her understanding and overwhelming sup-
port.

To my Wife and Son for their eternal love.

I dedicate this work...

Mahmoud Ahmad Mohammad Ramlawi

Declaration:

I certify that this thesis submitted for the degree of Master, is the result of my own research, except where otherwise acknowledged, and that this study (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Signed

Mahmoud Ahmad Mohammad Ramlawi

Date: 21.04.2019

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Abstract

Background:

Streptococcus pneumoniae can asymptotically colonize the nasopharynx and cause a various range of illnesses. Pneumococcal conjugate vaccines (PCVs) are at present used in different countries. The aim of the study is to determine the effect of different vaccination policies PCV7/13 to that PCV10 on the carriage rates and comparing the impact of different vaccination policies in East Jerusalem and West Bank region.

Methods:

Five cross-sectional surveillances of *S. pneumoniae* were carried out in East Jerusalem and Palestinian authority (PA), where two Palestinian populations with different vaccination policies were screened, with an annual average of 348 and 616 children., respectively, were performed during 2009-2016. Nasopharyngeal swabs and data were collected from children less than 5 years old visiting primary care physicians who visited any of three private pediatric clinics in Bethlehem, Nablus, and Ramallah in PA. In East-Jerusalem (EJ), PCV7 was implemented in 2009 and replaced by PCV13 in late 2010, while in Palestine (PA), PCV10 was implemented in 2011.

Swabs were streaked and incubated overnight at 35°C in 5% CO₂ enriched air to detect the presence of *S. pneumoniae*. Presumed colonies of *S. pneumoniae* were identified by morphological characteristics, such as α hemolysis and optochin susceptibility. *S. pneumoniae* serogroup was determined by the latex agglutination test and *S. pneumoniae* serotype was determined and confirmed using PCR and gel-electrophoresis.

Results:

A total of 4686 children were screened in EJ (n=1615) and PA (n=3070), the overall rate of *S. pneumoniae* carriage did not change significantly during the 5 first years of the study, in either population. The pediatric subjects from EJ were determined to carry *S. pneumoniae* during the 5 years study, 2009, 2010, 2011, 2014, and 2016 as 28.9%, 29.3%, 26.9%, 30.7% and 16.9%, respectively. In addition 35.9%, 33.6%, 28.8%, 28.6% and 32.9% of the pediatric subjects from PA were shown to carry *S. pneumoniae* in 2009-2016, respectively. By year 2016, *S. pneumoni-*

ae carriage was reduced significantly in EJ from ~29% on average to ~17%, following seven years application of PCV7/13. In PA, where follow-up included only 5 years after PCV10 application, *S. pneumoniae* carriage remained ~30%. Interestingly, VT7 strains gradually decreased following PCV implementation. Following vaccine implementation, during the study period, there was a significant decrease in carriage of *S. pneumoniae* in the EJ between 2009 and 2016 ($P=0.001$). No significant variation was seen in the overall carriage of *S. pneumoniae* between 2009 to 2016 in PA ($P=0.065$). PCV10 was introduced to PA late in 2011, but *S. pneumoniae* carriage was approximately (160/566) 28% in 2011, prior to vaccine introduction, and (216/656), 32.9% in 2016, five years following vaccine implementation.

In PA region, PA VT13-10 strains declined from 18.87% in 2011 to 9.78% in 2014, but re-emerged to 18.06% in 2016.

In both EJ and PA, a significant increase of non-VT isolates was observed between 2009 and 2016 following vaccine implementation ($P<0.0001$ in both regions). Between 2009 and 2016, in EJ and PA, there was a decrease in PNSSP prevalence following vaccine implementation ($p=0.2251$ and $p=0.1864$, respectively).

S. pneumoniae carriage among the parents was relatively rare, with 3.3% of parents detected as nasopharyngeal carriers in both regions throughout the five study years.

Conclusions: Following PCV implementation, a decrease in the prevalence of VT strains was observed in EJ, and PA.

Keywords: *Streptococcus pneumoniae*, pneumococcal conjugate vaccine, vaccine-type strain, non-vaccine type strains, 7-valent PCV (PCV7),

مقارنة التأثيرات المبكرة لسياسات التطعيم ضد الالتهاب الرئوي على النقل البلعومي لدى

السكان الفلسطينيين.

اعداد:محمود احمد محمد رملوي

اشراف:د.كفاية عزمي

الملخص:

خلفية الدراسة: بامكان المكورات العقدية الرئوية السيطرة على البلعوم الأنفي بدون أعراض وتسبب مجموعة متنوعة من الأمراض حيث حاليا تستخدم لقاحات المكورات الرئوية (PCVs) في بلدان مختلفة. تهدف الدراسة إلى تحديد تأثير سياسات التطعيم المختلفة PCV7/13 وكذلك PCV10 على معدلات الإصابة ومقارنة تأثير سياسات التطعيم المختلفة في القدس الشرقية والضفة الغربية.

منهجية البحث:تم إجراء خمسة دراسات مسحية للالتهاب الرئوي في القدس الشرقية والضفة الغربية خلال 2009-2016، حيث تم فحص قسمين من السكان الفلسطينيين مع سياسات التطعيم المختلفة ، بمتوسط سنوي 348 و 616 طفلا، على التوالي. حيث تم جمع مسحات البلعوم الأنفي وبيانات من أطفال تقل أعمارهم عن 5.5 سنة يزورون أطباء الرعاية الأولية من عيادات طب الأطفال الموجوده بالمناطق التالية بيت لحم ونابلس ورام الله في الضفة الغربية. تم الاقرار بتنفيذ PCV7 في القدس الشرقية في عام 2009، وحل محله PCV13 اواخر عام 2010 ، بينما في الضفة الغربية تم تنفيذ PCV10 في عام 2011.

تم زراعة المسحات ووضعها في حاضنه تحمل عند 35 درجة مئوية من الهواء المخصب من ثاني أكسيد الكربون طوال الليل للكشف عن وجود المكورات الرئوية. تم التعرف على المستعمرات المفترضة للالتهاب الرئوي بالخصائص المورفولوجية ، مثل انحلال الدم ألفا وحساسية الاوبتشتين (optochin susceptibility).

تم تحديد المكورات الرئوية عن طريق اختبار latex agglutination وتم تحديد المصل المكورات الرئوية وتأكيدها باستخدام PCR والهلام الكهربائي (gel-electrophoresis).

النتائج: تم فحص مجموعه 4686 طفلاً في القدس الشرقية (عدد= 1615) والضفة الغربية (عدد = 3070) ولم يتغير المعدل الإجمالي للنقل العقدي الرئوية بشكل ملحوظ خلال السنوات الخمس الأولى من الدراسة ، في أي من السكان. تم تحديد اصابات الأطفال في القدس الشرقية الذين يحملون المكورات الرئوية خلال دراسة السنوات الخمس (2009 ، 2010 ، 2011 ، 2014 ، و 2016) بنسبة 28.9 % ، 29.3 % ، 26.9 % ، 30.7 % و 16.9 % ، على التوالي. بالإضافة إلى ذلك تبين أن 35.9 % ، 33.6 % ، 28.8 % ، 28.6 % و 32.9 % من الأطفال المصابين بالضفة الغربية يحملون التهاب رئوي على التوالي. بحلول عام 2016 ، انخفض معدل نقل الرئوية بشكل كبير في القدس الشرقية من 29% في المتوسط إلى 17% تقريباً، بعد تطبيق PCV7/13 لمدة سبع سنوات. اما في الضفة الغربية تشمل المتابعة بعد 5 سنوات فقط من تطبيق PCV10 ، بقيت المكورات الرئوية ما يقارب 30 % . ومن المثير للاهتمام ، ان سلالات نوع اللقاح (VT7) انخفضت تدريجياً بعد تنفيذ اللقاح (PCV).

خلال فترة الدراسة ، كان هناك انخفاض ملحوظ في نقل البكتيريا الرئوية في القدس الشرقية بين عامي 2009 و 2016. لم يلاحظ أي اختلاف كبير في النقل الكلي للالتهاب الرئوي بين عامي 2009 و 2016 في الضفة الغربية. تم إدخال PCV10 إلى الضفة الغربية في أواخر عام 2011 ، ولكن نقل الرئوية كان حوالي (160/566) 28 % في عام 2011 قبل إدخال اللقاح ، و (216/656) 32.9 % في عام 2016 ، بعد خمس سنوات من تنفيذ اللقاح في منطقة الضفة الغربية ، انخفضت سلالات VT13-10 أيضاً من 18.87 % في عام 2011 إلى 9.78 % في عام 2014 ، ولكن عادت إلى 18.06 % في عام 2016. في

كل من القدس الشرقية والضفة الغربية، لوحظت زيادة كبيرة في سلالات غير نوع اللقاح NVT بين عامي 2009 و2016 بعد تنفيذ اللقاح في كلتا المنطقتين. بين عامي 2009 و2016، في القدس الشرقية والضفة الغربية. كان هناك انخفاض غير مهم من الناحية الإحصائية في انتشار المكورات الرئوية المقاومة للبنسلين بعد تنفيذ اللقاح. كان نقل الالتهاب الرئوي بين الوالدين نادرًا نسبيًا، حيث تم اكتشاف 3.3% من الآباء على أنهم حاملات البلعوم الأنفي في كلتا المنطقتين خلال سنوات الدراسة الخمس.

الاستنتاجات: بعد تنفيذ لقاح المكورات الرئوية، لوحظ انخفاض في انتشار سلالات من نوع اللقاح في القدس الشرقية، الضفة الغربية.

الكلمات المفتاحية: المكورات العقدية الرئوية (*Streptococcus pneumoniae*)، لقاح المكورات الرئوية (pneumococcal conjugate vaccine PCV)، سلالة من نوع اللقاح (VT)، سلالات من النوع غير اللقاح (NVT).

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