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Analyzing Personal, Visit History, and Medical Trends in Non-Immunized Children

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Abstract

Objective: Given recent outbreaks of previously eradicated diseases, an understanding of potential trends among non-immunized patients may be helpful in achieving widespread vaccination. The main objective of this study is to identify potential trends in personal data, usage of the medical system, and medical histories of non-immunized children.

Methods: Retrospective chart analysis including patients aged 13 months through 8 years. Patients were split into three groups: non-immunized, non-MMR (partially immunized but not against measles, mumps, and rubella), and immunized (control). Three types of data were retrieved: personal data (age, gender, distance from family practice), No of visits in past 36 months (organized by provider and type of visit), and medical history (number of active medications and diagnoses). A t-test comparison assuming $p<0.02$ to be significant was used to compare mean values of groups. Where applicable, statistical tests were performed both including and excluding injection visits.

Results: 1835 were included, n=22 for non-immunized, n=5 for non-MMR, n=1808 for immunized (reduced to n=180 sample cohort). No differences between were found in personal data and minimal differences were found in medical history. For visit history, control patients had significantly more total visits than non-immunized patients, both with injections excluded (63% more, $p=0.0059$) and included (78% more, $p=0.00097$). By provider, non-immunized and non-MMR patients had significantly less urgent care clinic visits than control patients ($p<0.00001$, $p=0.0026$ respectively) while only the non- immunized group had significantly less physician visits and registered nurse injection- included visits ($p=0.0037$, $p=0.014$ respectively). By type of visits, there was no significant difference in wellness visits yet both non-immunized and non-MMR patients had significantly fewer regular visits ($p<0.00001$, $p=0.015$ respectively).

Conclusion: The study found non-immunized children to have fewer optional visits than immunized children suggesting that parents who disapprove of vaccination may also disapprove of medical management and intervention as a whole.

Keywords: Immunization; Vaccination; Vaccines

Abbreviations: MFHT: Markham Family Health Team; MMR: Measles, Mumps, Rubella; DTP: Diphtheria, Tetanus, Pertussis; Hib: Haemophilus influenza type B; EMR: Electronic Medical Record; UCC: Urgent Care Clinic; MD: Medical Doctor; GP: General Practitioner; NP: Nurse Practitioner; RN: Registered Nurse; Pharm: Pharmacist; RD: Registered Dietician; OT: Occupational Therapist; SW: Social Worker

Introduction

Vaccines are a safe and cost-effective way of reducing an individual's risk of contracting preventable diseases [1,2]. Childhood immunizations, in particular, are effective against preventing contraction of MMR, DTP, varicella, pneumococcal associated infections, meningococcal disease, polio, and Hib [3-14]. Reducing the chance of contracting such diseases has benefits beyond improved individual physical health, including increased readiness for school, and remains important to preventing widespread disease outbreaks [15,16].

Recent headlines highlight a measles outbreak in the US and a case of diphtheria in Spain [17,18]. Given this recent measles outbreak and a decline in MMR uptake in the late 1990s and early 2000s, analysis aimed at better understanding the non-immunized pediatric population remains important [19-21]. A better understanding of the characteristics of the non-immunized pediatric population may lead to more targeted vaccine coverage strategies, potentially leading to increased vaccination coverage.

Attitude towards vaccinations is an important factor in parental acceptance of vaccination, notably influenced by patient and parent interaction with the MD [22-24]. Higher parental education and higher household income have consistently been associated with increased vaccination coverage [24-31]. However, living in a densely populated house, having a parent working in the agricultural industry, being self- employed, or un-employed, and having older siblings are associated with decreased vaccination coverage [24,27,28,30,32]. Effects of ethnicity (particularly being of Asian descent), maternal age, and location of residence (urban Vs rural) on vaccination coverage vary between studies and communities [25,27,28,30,33].

Though a higher number of outpatient visits is associated with higher influenza vaccine coverage, no in-depth chart analysis of the health care visit histories of children lacking non-annual vaccines (i.e. excluding the influenza vaccine) was found [34]. In addition, no

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in-depth chart analysis of the medical histories of non-immunized pediatric patients was found. Therefore, the present study will analyze the non-immunized pediatric patient population to identify any potential trends in their personal characteristics, usage of the medical system, and medical histories.

Methods

This study was a retrospective chart review for patients between ages 13 months and 8 years using MFHT's internal EMRs. Patients with incomplete EMRs, those with immunizations entered incorrectly (i.e. in the incorrect section of the EMR), and those who had transferred to another primary care provider (either another GP or a pediatrician) were excluded because there is an increased probability for inaccurate data with these patients.

Remaining patients of this age group were split into three categories. Group A (non-immunized) consisted of patients who had not been given any vaccines since birth (excluding the annual influenza vaccine). Group B (non-MMR) consisted of patients who had been partially immunized, yet had never been immunized against MMR. The control group (immunized) consisted of patients who had been immunized using the MMR vaccine and at least two other vaccines since birth. This control group (immunized) was reduced to a sample size one-tenth of its original size using a periodic sample on an alphabetically sorted list.

Three types of data were retrieved on the three groups of patients using the EMR: personal data, visit history, and medical data. Personal data included the patient's age, gender, and the kilometer distance his or her listed residence was from MFHT (377 Church Street, Markham, ON, Canada) according to Google Maps. Visit history consisted of a record of the patients' visits to any of the following at MFHT over a 36- month period (06/01/2012-06/01/2015): UCC, MD, NP, RN, or other services (Pharm, RD, OT, SW). For MD, NP and RN visits, the type of visit was also recorded: wellness visit (commonly known as a physical exam), regular visit, or injection (only for RN visits). Medical data included the active medications and diagnoses to date.

The three groups of patients were analyzed using a t-test comparison of mean values (assuming $p<0.02$ to be a significant difference). There were three comparisons made: A Vs control, B Vs control, and A+B combined Vs control. Where applicable, mean values were calculated both including and excluding injection visits to an RN because non-immunized or non-MMR patients typically do not have a purpose for booking an injection visit. Statistical analysis was performed using Stat Plus version 5.8.0 software (Softonic International S.L., Barcelona, Spain).

Results

2014 patients were identified between the ages 13 months and 8 years of which 179 were excluded. Of the remaining 1835 patients, 22 (1.2%) were identified as group A (non-immunized) and 5 (0.3%) were identified as group B (non-MMR). The 1808 patients in the control group (immunized) were reduced to a sample size of 180 patients.

Table 1 shows an overview of the t-test comparisons with regards to personal data. It was determined that any differences in personal data were insignificant.

With regards to total visit history, it was determined that control group patients had significantly more total visits than group A patients (injections excluded: 63% more and p=0.0059, injections included: 78% more and p=0.00097). While there were observed differences between group B patients and control patients in total number of visits, these were determined to be insignificant. It was also determined that control patients had more total visits than the patients of the combined group A+B (injections excluded: 58% more and p=0.0050, injections included: 73% more and p=0.00056). Total visit history results between Figure 1 and Table 2.

Visit comparisons, organized by provider, are summarized in Figure 2 and Table 3. Group A patients used the UCC, MD, RN (injections included), and other services (Pharm, RD, OT, SW) significantly less than control group patients.

	Control	A	p-values	B	p-values	A+B	p-values
	Immunized (n=180)	Non immunized (n=22)	A Vs Control	Non-MMR (n=5)	B Vs Control	Non immunized+Non MMR (n=27)	A+B Vs Control
Age(years)	5.17	4.56	0.27	5.62	0.79	4.76	0.44
Age(years)	48	50	0.85	20	0.24	44	0.75
Gender (% male)	17.97	15.94	0.63	22.62	0.63	17.18	0.84

Table 1: Personal data t-test comparisons A Vs control, B Vs control, A+B Vs control.

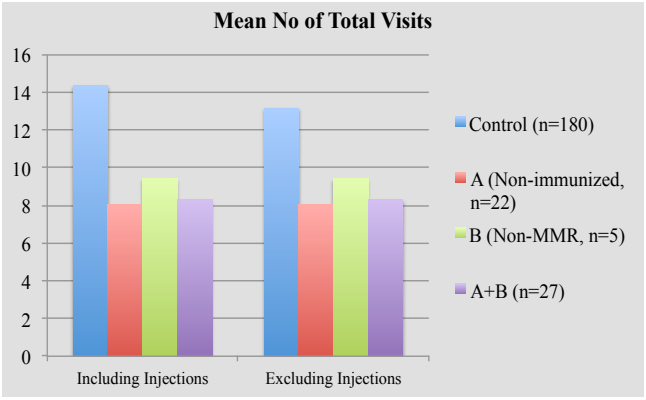

Figure 1: Mean number of total visits.

	p-values	p-values	p-values
	A Vs Control	B Vs Control	A+B Vs Control
Excluding Injections	0.0059	0.43	0.005
Including Injections	0.00097	0.32	0.00066

Table 2: P-values for t-test comparisons for number of total visits.

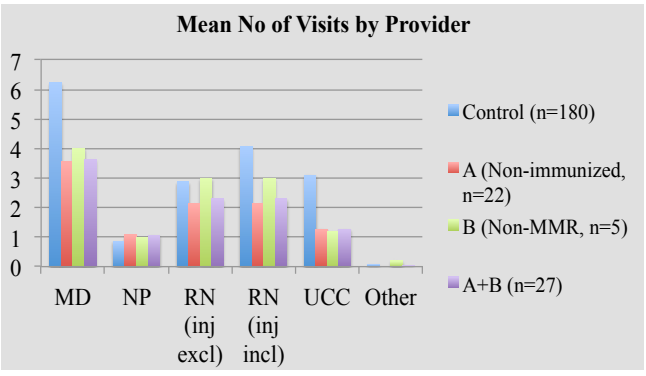

Figure 2: Mean number of visits by provider.

Group B patients were determined to use the UCC significantly less than control group patients. The combined group A+B patients were determined to have used the UCC, MD, and RN (injections included) significantly less than control group patients.

Visit comparisons, organized by type of visit (MD, NP, RN visits only), are summarized in Figure 3 and Table 4. There were no significant differences in mean number of wellness visits of any of the three groups (A, B, A+B) compared with the control group.

However, patients of all three groups (A, B, A+B) did have significantly less regular visits (specifically MD and RN regular visits) than control group patients.

	p-values	p-values	p-values
	A Vs Control	B Vs Control	A+B Vs Control
MD	0.0037	0.27	0.0017
NP	0.656	0.86	0.63
RN (Injections excluded)	0.327	0.95	0.42
RN (Injections included)	0.014	0.61	0.017
UCC	<0.00001	0.0026	<0.00001
Other services	0.019	0.6	0.37

Table 3: P-values for t-test comparisons for number of visits by provider.

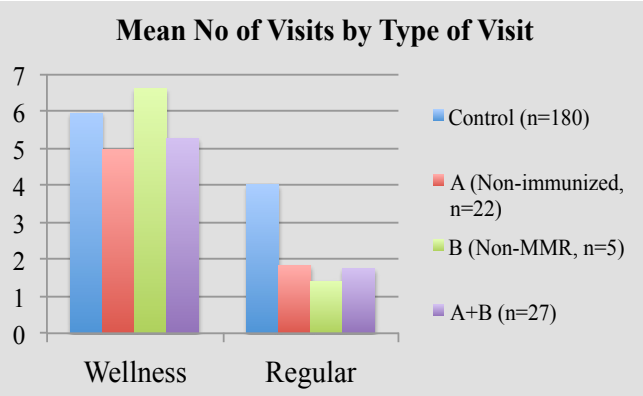

Figure 3: Mean number of visits by type of visit (MD, NP, RN visits only).

Discussion

With no significant differences between the groups in personal data and only one significant difference in medical data, the majority of significant differences lie in the visit histories of the three groups. The findings of the present study suggest that vaccine rejection may be associated with fewer visits to a medical professional of any kind. This result is in accordance with the study by Antonova et al. that suggests a potential association between number of outpatient visits and influenza vaccination [34].

Specifically, the present study's findings suggest that children who are unvaccinated (for either just MMR or all diseases) are less likely to visit the UCC, the MD on a regular visit or the RN on a regular visit. What UCC and regular visits have in common is that they are both typically based around management through medication or intervention. In contrast, medical wellness visits (commonly referred to as physical exams) are diagnostic based and routine. The lack of a significant difference between vaccinated and unvaccinated children in number of wellness visits suggests that parents who opt out of vaccination may only be opting out of the visits which involve medical management and intervention (regular and UCC visits), rather than the routine diagnostic ones.

Interestingly, as shown by Table 5, the only significant difference in medical data between patients of these three groups (A, B, A+B) as compared with the control patients was fewer diagnoses for group B patients than control group patients (p=0.00069).

The correlation between non-immunization (for MMR or all diseases) and a lower number of visits potentially involving medications and other interventions (regular or UCC) may suggest that parents who oppose vaccinations also oppose medical intervention. If a child were to have a bad cold or a sprained ankle, the findings of the present study suggest parents of non-immunized children are less likely to book an appointment with an MD or RN or visit the UCC than those of immunized children. Perhaps then, campaigns aimed at targeting parents opposed to vaccination would be more effective if they addressed these parents' concerns with the medical intervention as a whole. However, the present study's findings

	Control	A	p-values	B	p-values	A + B	p-values
	Immunized (n=180)	Non- immunized (n=22)	A Vs Control	Non-MMR	B Vs Control	Non-immunized + Non-MMR (n=27)	A+B Vs Control
Wellness	5.94	4.95	0.53	6.6	0.88	5.26	0.64
MD Wellness	3.42	2.36	0.17	3	0.82	2.48	0.19
NP Wellness	0.3	0.55	54	0.6	0.65	0.56	0.45
RN Wellness	2.22	2.05	0.81	3	0.71	2.05	0.66
Regular	4.02	1.82	<0.00001	1.4	0.015	1.74	<0.00001
MD Regular	2.82	1.18	<0.00001	1	0.013	1.15	<0.00001
NP Regular	0.56	0.55	0.96	0.4	0.57	0.52	0.83
RN Regular	0.65	0.091	<0.00001	0	<0.00001	0.074	<0.00001

Table 4: P-values for t-test comparisons for number of visits by type of visit (MD, NP, RN visits only).

	Control	A	p-values	B	p-values	A+B	p-values
	Immunized (n=180)	Non- immunized (n=22)	A Vs Control	Non-MMR (n=5)	B Vs Control	Non-immunized + Non-MMR (n=27)	A+B Vs Control
No of Active Medications	0.99	0.64	0.17	1	0.99	0.7	0.21
No of Diagnoses	0.13	0.14	0.94	0	0.00069	0.11	0.85

Table 5: Medical data t-test comparisons A Vs control, B Vs control, A+B Vs control.

are not sufficient to assess the effectiveness of such campaigns and further analysis must be done.

The limitations of the present study include a lack of patient contact, as it was a retrospective chart analysis. Surveys, questionnaires, and interviews would be necessary and are recommended to further analyze the attitude of parents opposing vaccination towards the entire medical system. In addition, the present study is limited as it is based out of only one family practice, MFHT, and analysis of other medical practices, particularly pediatric practices, is recommended to further understand trends in non- immunized children. The study is also limited by lack of access to hospital data and an analysis of hospital visits, in addition to reason for visit, could provide a more in depth understanding of the relationship between unvaccinated children and their usage of the medical system. Therefore, it is recommended that future studies be done to include analysis of hospital data, inclusion of pediatric practices, and interaction with parents through surveys, questionnaires, and interviews.

Conclusion

The present study results indicate a relationship between non-immunization and fewer optional medical visits (i.e. regular and UCC visits), which suggests that parents who disapprove of vaccination may also disapprove of medical management and intervention. The ramifications of this conclusion include that campaigns targeted at increasing vaccination rates may be more effective if aimed at increasing acceptance of medications and intervention. However, further investigation involving pediatric practices, hospital medical records, surveys, questionnaires, and interviews is recommended to gain a better understanding of the attitude of parents, who oppose vaccination, towards the entire medical system.

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