









RESEARCH ARTICLE

UPDATE Differences in antibiotic use and knowledge between adolescent and adult mothers in Ecuador [version 2; peer review: 2 approved]Arturo Quizhpe P^{1,2}, Martyna Gassowski³, Lorena Encalada T⁴, Francoise Barten⁵¹International Center for Health Systems Research and Education, Radboud University Nijmegen Medical Centre, 500 HB, Nijmegen, The Netherlands²Faculty of Medical Sciences, University of Cuenca, Cuenca, EC010107, Ecuador³Radboud University Nijmegen Medical Centre, 6500 HB, Nijmegen, The Netherlands⁴Department of Internal Medicine, University of Cuenca, Cuenca, EC010107, Ecuador⁵Department of Primary and Community Healthcare, Radboud University Nijmegen Medical Centre, 6500 HB, Nijmegen, The Netherlands**v2** First published: 10 Apr 2013, 2:108 (<https://doi.org/10.12688/f1000research.2-108.v1>)
Latest published: 08 Jul 2013, 2:108 (<https://doi.org/10.12688/f1000research.2-108.v2>)**Abstract****Objectives:** To investigate the differences in antibiotic use and knowledge between adolescent and adult mothers of children under the age of 5 years in Ecuador.**Methods:** A cross sectional study was performed in four health centers and hospitals. Mothers of children under five years, seeking medical attention their child's upper respiratory tract infection (URI), were included. The data was collected through interviews, using a structured questionnaire. The questionnaire covered the topics knowledge of antibiotic treatment, risk and resistance.**Results:** 777 mothers were included in the study, of which 15.8% were adolescent and 84.1% adult mothers. There were significant differences in the social and economic characteristics of the mothers ($p \leq 0.05$), with adolescent mothers being more likely to have an incomplete high school education and lack of basic services in their home. Significant differences between these groups were found in adherence to treatment, knowledge about risks associated with antibiotic use, and having heard of antibiotic resistance. Among the adult mothers, 83.5% reported correct adherence, 28.5% were knowledgeable about risks associated with antibiotic use, and 29.3% had heard of antibiotic resistance. Among the adolescent mothers, these numbers were 75.4%, 15.0%, and 19.8%, respectively.**Conclusions:** To develop successful interventions, it is crucial to understand the factors causing differences in antibiotic use and knowledge between mothers.**Keywords**

Child care, child health, maternal educational status, patient education, antibiotics, Latin America

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version 2	report	
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- Andrew Gilbert**, University of South Australia, Adelaide, SA, Australia
- Liliana Clara**, Hospital Italiano de Buenos Aires, Buenos Aires, Argentina

Any reports and responses or comments on the article can be found at the end of the article.

Corresponding author: Arturo Quizhpe P (aquizhpe@yahoo.com)

Competing interests: No competing interests were disclosed.

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UPDATED Changes from Version 1

We thank the referees for assessing our report. In this updated version we have added a paragraph at the end of the discussion highlighting the statistical limitations of the study and the need for more analytical approaches in future studies.

See referee reports

Introduction

Antibiotics are potent drugs, which since their discovery have saved millions of lives. However, when used incorrectly, they can pose a health risk to the patient, as well as contribute to the development of bacterial resistance to these drugs. Considering the already alarming levels of resistance reported worldwide^{1,2} an improvement in use, in terms of indications for treatment, choice of antibiotic, dosage, duration and enhanced knowledge, are crucial steps towards containment of the problem of resistance.

The majority of antibiotics are consumed in the community³, and in this setting there is plenty of opportunity for incorrect use. Particularly in countries with lack of access to and availability of health care, poor drug control, and lack of education of the population, self-medication is often common practice^{4,5}. The high cost of medicines, incomplete treatment courses, and patient pressure on the physician for a prescription, contribute to the misuse of antibiotics. Studies from both developed and developing countries show that misconceptions about antibiotics and their use are prevalent in the lay populations⁶⁻⁹. It is for example frequently thought that antibiotic treatment is indicated in conditions such as the common cold, which in most cases is a condition of viral etiology⁴⁻⁶. The financial aspect also influences the use of antibiotics, and poor patients will often not be able to afford a doctor visit or full treatment¹⁰. On the other hand, many health care systems do not make an effort to educate either the lay population about the importance of correct use of antibiotic, or the physicians about how to best deal with these problems.

In Ecuador, little is known about the use of antibiotics and the relevance of educational efforts made. In a review of the use and misuse of antibiotics in Latin America, M. J. Wolff described an “antibiotic culture” where treatment often is thought to be indicated at any sign of a suspected infection, which results in frequent self-medication⁴. In order

to be able to address this and other incorrect antibiotic use through interventions, it is important to first identify the causes of these behaviors in the local context, as well as the differences between different groups in the society. Preschool children are a group that are highly exposed to antibiotics in the community^{11,12}. However, in the case of such young children, the final decision about antibiotic treatment is taken by the child’s care giver, usually the mother. In Ecuador, despite an over-all decreasing fertility rate, the group of adolescent mothers is steadily increasing¹³. Thus, the aim of this study was to investigate whether there are differences in antibiotic use and knowledge between adolescent and adult mothers, seeking care for an upper respiratory tract infection (URI) in their child, aged less than five years. URIs are the leading cause of morbidity and doctor consultations in children under the age of five in Ecuador¹⁴, and it was therefore chosen as a reference condition for the study.

Methods

Ethics

Patients were informed about the study and its goals and oral informed consent was obtained.

Study sites

This cross sectional study was performed between February and April 2011, in four health centers and basic hospitals in the provinces of Azuay and Guayas in southern Ecuador. The sites were selected to represent a variety of ethnicities, local cultures, and climatic regions. The selected study sites are located in the highlands and in the coast and cover both urban and rural populations. **Table 1** gives an overview of the characteristics of each of the health facilities and the populations they cover.

Study design and sampling

The data analyzed in this article came from a larger cross-sectional survey aimed at investigating perceptions of disease severity, treatment and antibiotic use in caregivers of children under the age of five. The data was collected through interviews, using a structured questionnaire. All mothers of children under five years of age, seeking medical attention in one of the study sites for a respiratory tract infection in the child, were eligible for the study. Due to low numbers of attendance in the health center in Nabon, the approach was changed and the participants from this study site were recruited during medical visits in the home. The aim was to include 200 participants from each of the study sites.

Table 1. Basic characteristics of the population covered by each health facility.

Study site	Geographical location	Population covered	Urban Population (%)	Main economical activity (%)
Basic hospital of Naranjal	South west of the Guayas province	53.800	67	Agriculture (49)
Basic hospital of Sigsig	South east of the Azuay province	24.635	14	Agriculture (56)
Health center “el Paraiso” (city of Cuenca)	North of the Azuay province	26.672	100	Private sector employment (80)
Health center of Nábón	South of the Azuay province	18.053	58	Agriculture (58)

Study questionnaire (Spanish version)<http://dx.doi.org/10.6084/m9.figshare.97231>**Outcome measures**

The questionnaire included questions about demographic and socioeconomic characteristics of the child, mother and family, and questions about antibiotic knowledge and use by the mother. The main outcome measures were if the mother had ever used antibiotics without previously consulting a physician; always gave the complete treatment course to her child; knew of any risk associated with antibiotic use; and had ever heard of antibiotic resistance. The secondary outcome measures were the source of antibiotics if not consulting a physician before use; reason for giving incomplete treatment course if ever doing so; source of information about risks associated with antibiotic use if having this knowledge; and source of information about antibiotic resistance if they had this knowledge.

Statistical analysis

The statistical analysis performed consisted of a descriptive analysis of the study population. To assess the significance of the differences between the adolescent and adult mothers, a Chi-square test was used, with level of significance set to $p \leq 0.05$. The data were analyzed using SPSS 17 for Windows.

Results

In total, 777 participants were included in this study. Of these, 123 (15.8%) were adolescent mothers (aged 19 years or younger at the birth of their child), while 654 (84.2%) were adult mothers. The mean age of the adolescent mothers was 17.5 years ($s = 1.3$), and 27.1 years ($s = 5.3$) for the adult mothers at the time of the study. **Table 2** shows the basic characteristics of the mothers and of their living conditions.

The groups differed significantly in social and economic characteristics. Adolescent mothers were more likely to have an incomplete high school or primary school education and to live in a rural area.

They also were more likely than adult mothers to live in a home lacking access to at least one of the basic services (electricity, running water or a connection to a sewage system). In addition, the number of children was lower in the group of adolescent mothers.

Adult mothers were significantly more likely to have at least two children under the age of five in the family and they were also more likely to have a family income exceeding one minimum wage per month, than were the adolescent mothers.

Table 3 shows the responses to the questions concerning antibiotic use and knowledge of the mothers. For all questions, less than 1% of the data was missing. Having used antibiotics without previously consulting a physician was common in both groups, with 30 (24.6%) of the adolescent mothers and 191 (29.2%) of the adult mothers having ever done so, but no significant difference between the groups was found. However, a significant difference was found in adherence to treatment, where 543 (83.5%) of the adult mothers stated that they always gave the complete antibiotic course to their child, compared to 92 (75.4%) of the adolescent mothers. The reasons behind not completing a treatment were also investigated, and the most frequently given reason in both groups was that the child was feeling better, stated by 19 (61.3%) in adolescent mothers and 60 (55.0%) in adult mothers. However, no significant differences were found between the groups in this aspect ($p < 0.061$).

Of the adult mothers, 185 (28.5%) stated that they knew of any of the risks associated with antibiotic use, such as antibiotic resistance, allergy and secondary effects compared to 18 (15.0%) of the adolescent mothers, a difference that was significant.

24 (19.8%) of the adolescent mothers and 191 (29.3%) of the adult mothers had heard of antibiotic resistance, and this difference was significant. The majority in both groups (56% of the adolescent mothers and 68.1% of the adult mothers) stated the physician as the source of this knowledge. There was no significant difference found between the groups either for this source, or for others.

Table 2. Basic social and economical characteristics of the mothers and of their living conditions.

	Adolescent mothers		Adult mothers		P-value
	Number	%	Number	%	
Completed high school education or higher	29	23.6	274	41.9	0.001
Live in rural area	74	60.2	692	45.3	0.003
Access to basic services ^a	31	25.2	287	43.9	0.000
More than two persons/bedroom	39	31.7	245	37.5	0.224
Two or more children <5 years of age in the family	34	27.6	275	42.2	0.003
Total family income of <263 USD per month ^b	69	56.1	298	45.8	0.036

^a Basic services is defined as having electricity, running water and connection to a sewage system in the home.

^b Gross minimum wage in Ecuador.

Table 3. Antibiotic use and knowledge of the mothers.

	Adolescent mothers		Adult mothers		P-value
	Number	%	Number	%	
Has ever used antibiotics without previously consulting a physician	30	24.6	191	29.2	0.295
Always gives complete treatment course to the child	92	75.4	543	83.5	0.031
Knows of any risk associated with antibiotic use	18	15.0	185	28.5	0.002
Has heard of antibiotic resistance	24	19.8	191	29.3	0.032

Differences in antibiotic use between adolescent and adult mothers

1 Data File

<http://dx.doi.org/10.6084/m9.figshare.97229>

Discussion

This study found that adolescent mothers more frequently used antibiotics incorrectly and had less antibiotic knowledge compared to adult mothers. A number of differences in the characteristics of the mothers and their living conditions were identified, showing a tendency of the adolescent mothers to have a lower level of education and income, and to be more likely to live in rural areas.

In regard to the level of education of the mothers, as one of the determinants of this study demonstrates, only 23.6% of adolescent mothers completed high school compared with 41.9% of adult mothers. A study in Cuba on educational level of mothers and their knowledge, attitudes and practices concerning acute respiratory infections in their children concluded that the most important variable for the adequacy of knowledge was the educational level, which highlights the fundamental and positive influence of this factor on the preventive and curative care that mothers provide for their children, results by regression of age of the mother and level of education were RP 0.91 95% (0.85–0.98)¹⁵.

Another study in Spain on appropriate use of antibiotics in primary health care points out that an adequate level of beliefs in parents about the indications of antibiotic use in several illnesses are associated with a high level of parental education (Odds Ratio, 2.04; 95% CI, 1.16–3.06). In relation to the level of education, 45.8% of mothers had only a primary school education. 73 children (21%) received antibiotics in the 3 months before the study. 27 parents (7.8%) bought antibiotics without prescription. 82 respondents (23.6%) stated that their pediatrician did not prescribe antibiotics in situations where they expected them to do so¹⁶.

As found in our study, the education of mothers is an influential factor in the knowledge and use of antibiotics in case of URIs, because it allows greater access to the basic information on health education in order to recognize the symptoms and signs that require urgent attention at a health care centre and adopt healthier lifestyles to decrease the level of child morbidity. Another study in 2008–2009 in

the Ahmedabad district in India, found that the prevalence of acute respiratory tract infections (ARI) was higher in low social classes (III, IV and V) (26.56%), illiterate mothers (24.4%) and first-time mothers (23.9%) and those living in overcrowded houses (28.5%). At the same time, the prevalence of ARI was lower in urban areas (17.2%) as compared to rural areas (26.8%). This difference is more likely due to a lack of availability of basic health services and other associated factors like overcrowding, low socio-economic status, absence of cross ventilation and indoor air pollution.

About one third (30%) of children belonged to upper social classes (I, II) and the remaining were in low social classes (III,IV,V). According to social class, prevalence of ARI was higher in lower social classes (III-31.4%, IV-22.1%, and V-26.2% respectively) and was statistically significant ($p < 0.001$). Prevalence of ARI was highest in children of illiterate (24.4%) and primary school educated (23.9%) mothers. This difference was not statistically significant.

The above study concluded that strengthening reproductive and child health phase II (RCH-2) or integrated management of childhood illness (IMCI) programs and raising female literacy levels will go a long way in preventing ARI and morbidity amongst children in general. Reorientation of IMCI strategy and training of health workers in peripheral areas regarding identification, management and timely referral of cases of ARI and strong supervision, monitoring and evaluation of rural care health services specifically for ARI are transcendental to improving the quality of the health care centers and decreasing the child morbidity and mortality¹⁷. A study conducted in eight countries in Latin American (Bolivia, Colombia, Ecuador, Guatemala, Nicaragua, Panama, Peru and Dominican Republic) in 2006 assessed the possible independent and combined action of the parent's educational level and the economic situation of the family with the risk of diarrheal and respiratory diseases among children under 5 years. For ARIs, the risk of illness decreased as the economic situation of the family improved. However, the mother's educational level played a contradictory role: the children of mothers with some education had a higher risk of respiratory illnesses than children of mothers without education. This may be because the women with lower educational levels have breastfed their children for longer or because women with some education could recognize milder respiratory conditions better.

We did not find synergistic effects between the father's educational level and the family's financial situation.

The Latin American study mentioned above found that better family economic situations reduced the risk of disease in the children of mothers with higher education than in mothers without formal education. Similarly, better education of mothers had a greater protective effect in the children of mothers with a better educational level than in poor families. A better economic situation can allow women to make better choices in regards to child health and helps them to provide their children with better hygiene, a healthy lifestyle and greater access to health care, while educated women living in more severe economic conditions do not always have access to these options for their child's health. The father's higher level of education had a protective effect, independent of the economic situation of the family. These results demonstrate that efforts to decrease poverty will have a greater protective effect on child health if they include efforts to improve the educational level of women and girls than if any of these efforts were to be made separately¹⁸.

It is believed that the age of the mother may be associated with the level of knowledge about URIs and the use of antibiotics. An analysis of a bivariate study in Spain showed that the level of knowledge was directly related to the age of the person who answered the survey: the older the mother, the higher the level of knowledge (34.5 years compared to 32.8 years) $p = 0.003$ ¹⁹.

The results of our study show that the knowledge about resistance and risks of antibiotic use is also not very high for adult mothers, where less than a third had heard of either. This points towards a generally low level of knowledge in the population and the lack of education programs at the community and hospital level.

As described in the results, the physician was stated as the most common source of information about antibiotic resistance by both the adult and adolescent mothers. This shows the potential of physicians as educators, and it should be taken into account when developing interventions targeting the lay population. We believe that the leadership of the medical professional is a key point for the knowledge of the appropriate use of antibiotics.

In a study on the general public's perceptions and use of antimicrobials in Trinidad and Tobago, it was shown that it was not uncommon for the study participants to incorrectly classify different painkillers and cough and cold formulations as antibiotics²⁰. It is possible that this occurred to a certain extent in this study as well, as the mothers' understanding of the term "antibiotics" was not investigated. Also, it is possible that some of the participants might have been giving desired answers, rather than truthful ones, when asked about self-medication and early termination of treatment.

Different studies show the importance of knowledge on the appropriate prescribing of antibiotics in children under 5 years, on the economic impact of respiratory infections on the family budget, and on the beliefs of mothers in regards to using antibiotics for acute respiratory infections without a prescription; however, the one

factor that contributed to treatment failure was maternal education ($p = 0.05$)²¹⁻²³. This highlights the importance of ensuring a higher level of education in this population group.

The mis- and overuse of antibiotics in the community are behaviors of a complex nature. They are the result of different socioeconomic, cultural, demographic and other factors interacting in ways specific to the local context. In order to identify these factors, multivariate analysis is needed, but even with the significant factors identified, only half the battle is won. In order to be able to develop successful interventions, it is crucial to first understand the mechanisms behind how these factors influence each other and the behaviors and attitudes towards antibiotics.

Little research has been done on the determinants of antibiotic use in the community, and the results are often contradictory^{6,15,16,19-21}. More attention urgently needs to be given to this part of the combat against antibiotic resistance, if the battle shall be won.

This is a descriptive study, the first addressing this subject in Ecuador as far as the authors are aware. The results show interesting differences in the knowledge and use of antibiotics between teenage and adult mothers. However, there were limitations to what could be statistically analyzed. Therefore a new study design is needed to confirm and quantify the association we have found. Given the current importance of the subject matter and the high prevalence of teenage mothers in our country, this line of research must be continued and requires validation by a more analytical research instrument and the integration of an expert in statistics into the team for the duration of the study.

Author contributions

AQ and FB conceived the study. AQ, MG and LE carried out the research. AQ, MG, FB and LE prepared the first draft of the manuscript. All authors were involved in the revision of the draft manuscript and have agreed to the final content.

Competing interests

No competing interests were disclosed.

Grant information

This research resulted from a partnership between the Faculty of Medical Sciences, University of Cuenca, Ecuador and Radboud University Nijmegen Medical Centre in the Netherlands. The Radboud University Nijmegen Medical Centre funded the travel and hosting of the student in Ecuador. The University of Cuenca helped with logistic support of the student in the health care institutions in Ecuador.

The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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Liliana Clara

Hospital Italiano de Buenos Aires, Buenos Aires, Argentina

Competing Interests: No competing interests were disclosed.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 17 July 2013

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Andrew Gilbert

Division of Health Sciences, School of Pharmacy and Medical Sciences, University of South Australia, Adelaide, SA, Australia

I am happy with the changes made to the paper and the clarification that this was a descriptive study. I congratulate the authors for the effort but into this study and hope that a follow-up study will be undertaken to further explore this important area in public health.

Competing Interests: No competing interests were disclosed.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 10 June 2013

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**Liliana Clara**

Hospital Italiano de Buenos Aires, Buenos Aires, Argentina

This article shows that education efforts should be targeted to concentrate more on these specific age groups.

Competing Interests: No competing interests were disclosed.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 15 April 2013

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**Andrew Gilbert**

Division of Health Sciences, School of Pharmacy and Medical Sciences, University of South Australia, Adelaide, SA, Australia

This is an interesting and important topic area to study. The paper is well written and the conclusions match the results of the data analysis. Basically it is stating the obvious: Older, more experienced mothers, who are generally better educated, have more money and have more children are better at using antibiotics and know about antibiotic resistance. The paper would benefit from having a statistician provide advice on data analysis; a better story could be told about the influence of age etc if logistic regression models were used.

One of main concerns in the interpretation provided in that it has missed the obvious question about, "were the older mothers the same as the young mums in terms of actions, knowledge and use of antibiotics. How would the older mums compare if those with only one child were compared with the younger mums; ie is knowledge about antibiotics and obtaining antibiotics for medical practitioners learnt "on the job". Planned regression modelling can answer questions such as this.

If no statistical support is available, the authors should at least acknowledge this and include in the

discussion a statement, such in the paragraph above, on weaknesses of this study. Any future study should include a statistician at the very first study planning session to ensure adequate data are collected via the questionnaire to answer the research question(s), and the appropriate statistical procedures. There is no mention in the study of basic statistical requirements such as a power calculation, for example.

Competing Interests: No competing interests were disclosed.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reader Comment 23 Apr 2013

Diana Andrade, University of Cuenca, Ecuador

Dr. Andrew Gilbert,

Your perspective is very interesting and your report has opened us up to a new way to show the results in the article, we hope to send it as soon as possible addressing all the suggestions contained in your review.

Thanks a lot Dr. Gilbert for the comments and support.

Kind regards,

Dr. Arturo Quizhpe, Dean at the Faculty of Medical Sciences, University of Cuenca.

Competing Interests: No competing interests were disclosed.

Reader Comment 20 May 2013

Diana Andrade, University of Cuenca, Ecuador

Dear Dr. Gilbert:

We have proceeded to perform the review and corresponding analysis according to your comments and suggestions. In a revised version, we will incorporate this and will be adding the following paragraph at the end of the text of the study: "This is a descriptive study. It is a pioneer in addressing this subject in Ecuador. The results show interesting differences in the knowledge and use of antibiotics between teenage and adult mothers. However, there were limitations to what could be statistically analyzed. Therefore a new study design is needed to confirm and quantify the association. Given the current importance of the subject matter and the high prevalence of teenage mothers in our environment, this line of research must be continued and requires the validation of a more analytical research instrument and integration of an expert in statistics into the team for the duration of the study".

We thank you for your support.

Kind regards, Dr. Arturo Quizhpe

Competing Interests: I haven't any competing interest

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