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ORIGINAL ARTICLE

Active educational intervention as a tool to improve safe and appropriate use of antibiotics

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Abstract Misconception about antibiotics use among the public has been widely outlined to be a main reason for inappropriate use of antibiotics including failure to complete treatment, skipping of doses, re-use of leftover medicines and overuse of antibiotics. The study was devised to evaluate whether education might be a potential strategy to promote safer use of antibiotics and reducing self-medication. Two hundred seventy one adults were asked to complete two questionnaires; a pre and posteducation. The questionnaires comprised of three parts consisting of 17 statements assessing the knowledge on: appropriate use, safe use and resistance of antibiotics. Knowledge score was estimated by calculating the percentage of correct responses. The mean (SD) knowledge score pre-education was 59.4% (20.3). However, posteducation the score was 65.9% (17.9), $p < 0.001$(*t*-test). Knowledge scores were classified as poor, adequate and good. Posteducation, participants within poor and adequate knowledge categories were significantly shifted to the good category describing better knowledge, McNemar-$\chi 2 = 28.7$, $df = 3$, $p < 0.001$.

It is concluded that using tailored education material targeting antibiotic need and use with a major aim of improving the public knowledge about antibiotics can be an effective and feasible strategy. This pilot study could be considered as the starting point for a wider scale public educational intervention study and national antibiotic campaign. However, the improvement in participant's knowledge might not reflect an actual change in antibiotics–seeking behaviour or future retention of knowledge. Future research should seek to assess the impact of education on participant's behaviour.

1. Introduction

Antibiotics are one of the most commonly purchased drugs. Over and inappropriate use of antibiotics account for 20–50% of all antibiotics used globally which is becoming a major concern particularly in developed countries (Bisht et al., 2009). Unnecessary use of antibiotics reported to be a fundamental reason for resistance (Levy and Marshall, 2004; Spellberg

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et al., 2008). Antibiotics resistance is a globally growing problem that contributes to real threats on public health and costs due to failure in the treatment and prevention of infectious diseases (Ozgenc et al., 2011; Shorr et al., 2011). Lack of adequate knowledge about antibiotics has been widely outlined to be a main reason for inappropriate use of antibiotics which includes failure to complete treatment, skipping of doses, re-use of left-over medicines and overuse of antibiotics (Kim et al., 2011; Ling Oh et al., 2011; You et al., 2008). Approximately, 50–75% of antibiotics administered daily in USA within hospital and community settings considered unnecessary because they were prescribed for viral infections particularly respiratory infections (Misurski et al., 2011; Rodis et al., 2004). One-third of adults in the United Kingdom incorrectly agreed that 'antibiotics work on most coughs and cold' and 43% incorrectly agreed that 'antibiotics can kill viruses' (McNulty et al., 2007). In Jordan, several studies demonstrated significant alerts, not only regarding the irrational prescription of antibiotics for the treatment of viral infections, but also the prevalence of self-medication and resistance (Al-Bakri et al., 2005; Suaifan et al., 2012; Yousef et al., 2008; cdc, 2015). In our previous work, we reported that adults in Jordan incorrectly believed that antibiotics can be effective in the treatment of common cold, cough and other viral infections. Furthermore, over 50% of the study population kept antibiotics at home for emergency use and prophylaxis against infections and used left-over antibiotics without physicians' consultation (Shehadeh et al., 2012; Suaifan et al., 2012). Therefore, pursuing strategies to enhance the rational use of antibiotics in Jordan was demanded.

Enhancing public knowledge about antibiotic resistance and appropriate use by educational interventions has been strongly advocated (Finch et al., 2004; Misurski et al., 2011; Ranji et al., 2008). The Infectious Diseases Society and the Society of Healthcare Epidemiology of America suggest education as an essential component of any programme designed to influence long-term prescribing behaviour of antibiotics. The primary objective of this study was to assess the impact of pharmacist-initiated educational intervention on participants' knowledge regarding appropriate and safe antibiotic use and resistance among adults in Jordan. The secondary objective was to evaluate the outcome of the pharmacist-initiated educational intervention on the enhancement of safer antibiotic use and reduction of self-medication.

2. Methods

Using a structured pre- and posteducational questionnaire, knowledge about appropriate antibiotics use and resistance was evaluated among a sample of adults living in Jordan. Questionnaires were developed by reviewing available content validated questionnaires in the literature (Chen et al., 2005; Ling Oh et al., 2011; McNulty et al., 2007; You et al., 2008). Questionnaires were then face validated individually by two clinical pharmacists, one statistician and one sociologist. This aimed to ensure applicability and appropriateness within the context of the Jordanian community. The questions were written with no medical jargons or difficult terminology. The questionnaires were pretested and validated on a pilot sample of 14 participants (5% of the target sample) to clarify any ambiguities.

A sample of adults (anybody who appeared to be 18 years old or above) were approached and verbally informed about the study. In order to ensure variation and generalizability within the study sample with respect to background, occupation, and education, participants were recruited at different public sites including shopping malls, supermarkets, gyms, female beauty centres. Data were collected between April and July 2012. Ethical approval for conducting the study was obtained from the Institutional Review Board (IRB) at Jordan University Hospital (JUH) and the Scientific Committee at the Deanship of Scientific Research at The University of Jordan.

The intervening pharmacist engaged participant in a 10 min dialogue session during which the pharmacist asked the participant to fill a pre-educational questionnaire (Table 1) assessing the background knowledge about antibiotics appropriate use and resistance. After this, the participant was verbally educated on one to one basis using educational card contained information based on the published educational materials by the Centre for Disease Control and Prevention (Yousef et al., 2008). Additionally, the educational card included further information outlined in the previously published recommendations (Shehadeh et al., 2012; Suaifan et al., 2012). Following the education, the participant was asked to complete a posteducation questionnaire.

The pre-education questionnaire comprised of three parts (17 statements) with the choice of answering either yes or no. The first part consisted of five statements designed to evaluate knowledge regarding the appropriate use of antibiotics. The second part consisted also of five statements regarding the knowledge on safe use of antibiotics by pregnant, lactating mother, children under 8 years old, if a family member is allergic to an antibiotic and as a prophylactic against infections. The final part consisted of seven statements regarding the knowledge on antibiotics resistance.

Posteducation questionnaire consisted of the same number of statements, but with slight re-wording. Statements were reworded not only to ensure authenticity of participants' responses but also to avoid ambiguity and to ensure that the changes in responses (if any) would provide a validated tool to measure participant's satisfaction with the educational intervention. Details of statements rephrased in the post-education phase are shown in Table 2.

Educational card entitled "Get smart, know when antibiotics can be used" and the study questionnaires were translated from English into Arabic and back into English by two senior academic staff members who are fluent in both languages to address any ambiguity and to determine whether the data would provide reliable information.

Responses were coded and entered into SPSS for Windows, version 16. Correct response comprised of participant agreement (yes answer) with some statements and disagreement (No answer) with other statements (as shown by asterisk (*) sign in Table 1) were used to calculate the knowledge score. One point was given for each correct response. Good knowledge score of 3 was given for participants with more than 70% correct response. Adequate knowledge score of 2 was given for participants with 50–70% correct response. Poor knowledge score of 1 was given for participants with less than 50% correct response. The analysis excluded those who answered 8 or less out of the 18 statements, i.e. missing data.

Table 1 Pre- and posteducation knowledge about antibiotics appropriate use and resistance.

	Correct responses N (%)	
	Pre-education	Posteducation
Antibiotics cure[a]		
Cold or flu	111 (41.4%)	226 (84.3%)
Cough and bronchitis	97 (36.6%)	220 (83.0%)
Sore throat	65 (24.8%)	205 (78.2%)
Runny nose	163 (65.5%)	210 (84.3%)
Congestion	86 (33.9%)	144 (56.7%)
Antibiotics safe to use[a]		
During pregnancy	47 (17.6%)	217 (81.3%)
During lactation	83 (31.1%)	208 (77.9%)
For children under the age of 8 years	138 (52.7%)	167 (63.7%)
If a family member is allergic to an antibiotic	46 (18.8%)	144 (56.7%)
As prophylaxis to protects from contacting infections	18 (6.7%)	209 (78.6%)
Antibiotics resistance due to[b]		
Taking left over	196 (73.1%)	230 (85%)
Taking them for cough, cold and flu	160 (59.5%)	225 (83.6%)
Use of the same antibiotic whenever you have fever	177 (65.6%)	227 (84.1%)
Not competing the whole course of antibiotics	183 (68.8%)	225 (84.6%)
Asking for antibiotic prescription over the phone	169 (65.5%)	216 (79.7%)
Buying antibiotics directly from pharmacy without prescription/using antibiotics without physician consultation	161 (59.9%)	220 (81.8%)
Use of antibiotics based o relatives or friends advice	177 (66.0%)	206 (76.9%)

[a] Disagreement with the statement considered a correct response and scored 1 point.
[**] Agreement with the statement considered a correct response and scored 1 point.

Student's *t*-test and McNemar test were used to analyse the data and compare the answers given pre and posteducation. *P* values less than 0.05 were considered significant. Descriptive measures were presented as mean (SD) percentage.

3. Results

A total of 271 participants completed pre- and post-education questionnaires. Only one questionnaire was excluded since more than eight answers were missing. The knowledge score mean (SD) for the pre- and post-education was 59.4% (20.3)% and 65.9% (17.9) respectively, $p < 0.001$(*t*-test). Table 1 shows the correct responses by participants for each statement in the pre and post-educational questionnaire.

3.1. Appropriate use of antibiotics

Pre-education, the participants admitted frequently using antibiotics for symptoms associated with viral infections. Knowledge score (SD) for appropriate use of antibiotics was 45.8% (24.3). Whereas, after education they were aware that antibiotics do not cure such symptoms; knowledge of appropriate use was notably higher (75.9% (29.1)), $p = 0.035$.

3.2. Safe use of antibiotics

In this context, posteducation participant response showed higher degree of awareness regarding antibiotics use by pregnant, lactating mothers and young children. Interestingly, most participants agreed correctly that antibiotics should only be used upon prescription by the physician with cautions to possible antibiotic allergy. The knowledge score (SD) for safe use of antibiotics in the pre- and post-educational phases was 23.8% (9.7), 76% (26.7), respectively, $p = 0.017$.

3.3. Knowledge about antibiotics resistance

Knowledge about antibiotics resistance improved significantly, $p < 0.05$. Pre-education, participants did not acknowledge common habits contributing to antibiotic therapy failure. The knowledge score (SD) for awareness about antibiotics resistance in the pre- and post-educational phases was 65% (30.1), 82% (29.7) respectively, $p = 0.032$.

Overall knowledge scores classified as poor, adequate and good are shown in Fig. 1.

Posteducation, participants within poor and adequate knowledge were significantly shifted to a category describing better knowledge, McNemar-$\chi 2 = 28.7$, $df = 3$, $p < 0.001$.

4. Discussion

Previous studies revealed that pharmacist educational intervention appeared to improve public knowledge of proper and safe antibiotics use, in addition to improvement in public understanding of antibiotics resistance (Finch et al., 2004; Gonzales et al., 2005; Ranji et al., 2008). This study highlights the impact of tailored educational material targeting antibiotics appropriate use and suggests that such a strategy can be an effective and feasible to improve patient awareness and knowledge.

Pre-education, participants admitted the often use of antibiotics to cure common cold symptoms and viral infections. A smart question to be raised! What is the difference between bacteria and viruses? Apparently, the above common

Table 2 Wording and rephrasing of the questionnaire statements in the pre- and posteducational questionnaires.

Pre-education	Posteducation rephrasing
Appropriate use of antibiotics	
Antibiotics cure *cold or flu*	Antibiotics cure *influenza*
Antibiotics cure *sore throat*	Antibiotics cure *viral* sore throat
Antibiotics cure *runny nose*	Antibiotics cure *watery nasal dripping*
Safe use of antibiotics	
All oral antibiotics are *safe* to be used to protect against diseases	Antibiotics can be used by people to protect themselves *from contacting infections*
All oral antibiotics are safe to be used during pregnancy	Antibiotics *can be used* by pregnant
All oral antibiotics are safe to be used even if a family member is allergic to antibiotics	Antibiotics can be used ***by patients*** who have a family member with antibiotic allergy
Antibiotics resistance	
• *Not responding to antibiotic treatment might be due:*	Failure of antibiotic treatment might be due
• *Taking left over antibiotics*	• Consuming *available antibiotics* from *previous treatments*
• *Taking the same antibiotic whenever you have fever*	• *Repeated use* of same antibiotic in different infections
• *Not completing the whole course prescribed by physician*	• *Stopping antibiotics whenever feeling better*
• *Asking* for antibiotic prescription *over the phone without examination*	• *Insisting* for antibiotics prescription for *all diseases*
• *Buying antibiotics directly from pharmacy without prescription*	• *Using antibiotics without physician consultation*
• *Use of antibiotics based* on relatives and friends *advice*	• *Taking antibiotics as recommended* by relatives and friends

Texts rephrased in italic and underlined font.

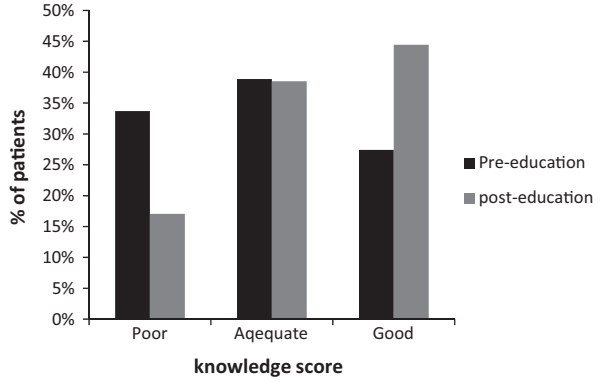

Figure 1 Participants pre and posteducation knowledge scores.

inappropriate practice of using antibiotics to treat viral infections revealed the poor understanding of the smart question. Participants' knowledge about the difference between bacterial and viral infection was unclear. Moreover, this inappropriate practice was widely outlined in the literature (Finch et al., 2004; Razon et al., 2005). Participants were unaware about the unsafe use of antibiotics by pregnant and lactating mothers, for young children and the risk of allergy towards some antibiotics. The percentage of those who wrongly thought that antibiotics can be used to protect against infection, was high too (93.3%). In comparison, posteducation participants showed a remarkable improvement in the level of knowledge of safe and appreciate use of antibiotics in addition to the awareness regarding resistance.

Remarkably, this improvement in participants' responses following pharmacist intervention supports the need for educational campaigns in Jordan. These campaigns should be carefully designed and aim to target all members of the community. Similar educational programmes were previously launched by the Centres for Disease Control and Prevention "Get Smart: Know When Antibiotics Work". These programmes mount further evidence that educational strategies and pharmacist intervention could bolster the efforts towards preventing unnecessary and irrational use of antibiotics by: promoting adherence to appropriate prescribing guidelines, decreasing demand on antibiotics for viral upper respiratory infections and increasing adherence to prescribed antibiotics (Suda et al., 2012). In Jordan, educational campaigns would add weight to the need to control the irrational habits as self-medication, sharing or using left over antibiotics (Al-Azzam et al., 2007; Yousef et al., 2008). This is, however, a general problem in many areas around the world highlighting the importance of public education campaigns against self-medication (Al-Azzam et al., 2007; Grigoryan et al., 2006; Ranji et al., 2008).

Despite the fact that Ministry of Health regulations restricts antibiotics as prescription only medications in Jordan, wrong practices by some pharmacists facilitate its acquisition without a prescription (cdc, 2015). However, we believe that pharmacists are the ideal health practitioners to provide public educational campaign. This is because pharmacists have easy and frequent contact with the public. Similar promising influence of pharmacist' role in conducting population directed educational campaign has been reported (Rodis et al., 2004). Moreover, employing pharmacy students in similar educational campaigns showed a positive influence (Greene et al., 2011).

5. Conclusion

Participants' knowledge of proper and safe antibiotic use in addition to the appropriate awareness regarding antibiotics resistance following pharmacist educational intervention was improved. The current study highlighted the major issues to be addressed by the future nationwide campaign.

6. Limitation

One of the limitations to our study would be the decision we made not to collect demographic information. Withstanding that, we are unable to fully describe the sample and examine the efficacy of the intervention among different individual subtypes. Other limitation is the size of the study sample. However, this was a pilot study aimed to build up a wider scale educational intervention campaign.

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