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## Comparison of need and supply of syringes for therapeutic injections in Pakistan

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### Abstract

**Objectives:** To determine the extent of shortfall in syringes by measuring the need from nationally validated sources and comparing it with position on the supply side. This was done in order to contribute to the ongoing national discussions that have focused on increasing syringe supply to curtail syringe reuse.

**Methods:** Using 'Injections received' data from the Pakistan Demographic Health Survey 2006-7 (N: 5429) and the National Hepatitis Survey (N: 47,043), the study estimated the number of injections received in Pakistan. We matched these against the local syringe production figures from the syringe manufacturers' association and import figures from the Federal Board of Revenue (FBR).

**Results:** Approximately 731±867 million injections (5.1±12 injections per head) are received annually in Pakistan and around 861±961 million syringes are supplied to the open market. Overall, 52-77% Pakistanis receive at least one injection in any given year.

**Conclusions:** Injection need in Pakistan is among the highest worldwide but is completely matched by available syringe supplies, suggesting lower reuse than previously considered. However, highly prevalent Hepatitis B and C viruses suggest that even this reuse is a major public health concern and measures directed at both providers and recipients of injections are needed to curtail high injection need and syringe reuse.

**Keywords:** Therapeutic Injections, HIV, Hepatitis, HCV, HBV, Syringe, Supply and need. (JPMA 62: 1149; 2012)

### Introduction

Unsafe injection practices, including excessive use of therapeutic injections and reuse of syringes, are major public health hazards and have likely contributed to the high prevalence of Hepatitis B and C<sup>1-6</sup> which now infect over 12 million people nationwide.<sup>1</sup> A recent outbreak of HIV in Gujrat (National AIDS Control Programme, 2009) has further highlighted the concerns for iatrogenic transmission of infections among the general public.

Therapeutic injections are commonly sought and administered in Pakistan<sup>4,7</sup> and are often unnecessary.<sup>8</sup> The majority are given in the private sector as most public-sector facilities seldom provide injections. This overuse is driven by a popular belief among healthcare providers and patients that injections are more effective and provide quicker relief than orally administered medicines.<sup>6,9,10</sup> Some patients even feel that a doctor's fee is unjustified unless an injection is given.<sup>11</sup> Some data suggest that syringe reuse is common with no or minimal attempts at sterilisation such as soaking in diluted alcohol or tepid water or simply wiping the needle with alcohol swabs.<sup>7,11,12</sup> These practices are further perpetuated by limited awareness among patients (and possibly some providers) about the hazards of using

unsterilised needles such as transmission of Hepatitis B or C and HIV infections. Additionally, there is a strong belief that the 'doctor knows best', hence, when injections are prescribed or syringes are reused by doctors, patients seldom object.<sup>10,11</sup> For their part, some providers would rather prescribe placebos or non-medicated injections such as distilled water or saline rather than take the time to explain the lack of need for an injection.<sup>11</sup>

There is an ongoing debate in Pakistan that limited supply of syringes may be driving their reuse. Previous estimates of the number of therapeutic injections received have ranged from 4.3<sup>7</sup> to over 10<sup>3</sup> per person annually; suggesting a national requirement for 0.7 to 2.5 billion syringes annually. Meanwhile, presentations by trade groups and some public health professionals have suggested that the national supply may be around 300-330 million, thus giving a shortfall of between 400 million and 2 billion syringes a year. This has led to the argument that individuals with limited resources are unable to purchase and use fresh needles each time they require injections, resulting in widespread reuse of syringes for therapeutic injections. National groups have, therefore, argued for increasing the national supply by as many as 1-2 additional billion syringes annually. On the other hand, the static national

prevalence of Hepatitis B and C over the past decade<sup>13</sup> suggest that syringe reuse may be less common than is speculated.

The study explored the need and supply of syringes for therapeutic injections in Pakistan to understand the dynamics of syringe reuse. Previous estimates of national injection frequency had been based mainly on small studies that were from limited locations and often done in response to outbreaks of Hepatitis, thus likely to overestimate the injections received. We calculated the total need for syringes for therapeutic injections by analysing data of two large national population level studies and compared this with the current supply of syringes in Pakistan to estimate the proportion of injections given with reused syringes.

## Material and Methods

The need for therapeutic injections in Pakistan was calculated from a population level study conducted by Pakistan Medical Research Council (PMRC) and the Pakistan Demographic Health Survey (PDHS), both of which asked subjects about therapeutic injections received during the preceding year. The data for the domestic syringe production in Pakistan was provided by the national syringe manufacturer's association: Pakistan Disposable Medical Equipment Manufacturers Association, a trade group. The Federal Board of Revenue (FBR) informed about imports. Collectively they accounted for the supply of injections in Pakistan.

In the PDHS 2006-7 a nationwide probability sample of 5249 women aged 15-49 were surveyed about their health and healthcare seeking including the number of medical injections received in the preceding 12 months. We proportioned these data to seven age groups and ascertained the average for the number of injections received by each age group. Since the survey excluded age groups below 15 years and above 49 years, we applied the assumption that the average of 15-19 years applied to the <15 group and the 45-49 group applied to the >49 group. Total number of injections received by women nationwide were then calculated by multiplying the mean injections received by each age group with the total population of women in Pakistan in that group as described by the Federal Bureau of Statistics (FBS). Since the PDHS interviewed only women, the number of injections for men was calculated by multiplying the injections for women with the FBS's national ratio of men to women i.e. 1.085: 1 (Table-1). The total number of injections received in Pakistan were then calculated by adding the totals of each age group.

In a study by the PMRC, a nationally representative sample of 47,043 men, women and children were asked about risk factors for Hepatitis B and C, including the number of injections received in the previous year. These injections were recorded in ranges of 2-4, 5-10 etc. These ranges were collapsed

to a mean: a range of 2-4, for instance, meant an average of 3 injections with the lower limit of 2 and upper limit of 4. We divided the study subjects into the same age groups as was done with the PDHS and then multiplied the mean number of injections by each of the age group with the total population of Pakistan in that group; the national total of injections received were calculated by adding the totals of each age group. Neither study asked about vaccines received and, therefore, the estimates of injections represented only therapeutic injections.

Syringes are both imported and manufactured in Pakistan. We obtained the estimates of the total number of syringes imported into Pakistan from the Federal Board of Revenue (FBR) that levies taxes on all imports, and accounted for all imports. Estimates of the syringes manufactured locally were obtained from the Pakistan Disposable Medical Equipment Manufacturers Association, which is a trade group with membership from over 20 of the largest syringe manufacturers in Pakistan. They also provided estimates of syringes manufactured by one large company that is outside the Association. The Association data likely includes over 95% of all syringes manufactured. Thus putting the 2 sources together, we likely accounted for around 90-95% of all syringes available in Pakistan.

Since this is an analysis of publicly available secondary data that did not involve human subjects directly (both constituent studies had appropriate ethical oversight), no additional ethical approval was sought for the study.

## Results

The PDHS data suggests that  $731 \pm 867$  million injections were received in Pakistan, or approximately  $5.1 \pm 12$  injections received per head per year (9.6 per head if one excludes the 48% subjects that never received any injections).

Estimates from the PMRC study suggested that a total of  $709 \pm 604$  million injections were received nationwide. Thus, the total number of injections received was  $4.3 \pm 3.8$  per person per year (5.3 if one excludes the 23% who never received injections) (Table-1).

Supply data estimated that about 450 million syringes were imported per year of which around 30 million annually were for vaccines and 10 million were insulin injections. Local manufacturers produced between 744-804 million regular single-use and approximately 10 million auto-disable syringes annually and estimated that around 25% of all syringes were sold to laboratories for diagnostic blood draws. No appreciable quantities of syringes were exported. Thus, the market supply of syringes for therapeutic injections was 861 to 961 million per year in Pakistan or an excess of 152-175 million syringes compared to the number of injections being received (Table-2).

**Table-1: Total Number of Injections Estimated from the Two Large National Surveys**

Age Group	Pakistan Medical Research Council Survey 2008										Pakistan Demographic Health Survey 2007														
	Population Estimates 2007					Total Injections					Mean Injections per year					Total Injections					Mean Injections per year				
	Men	Women	Mean injections per year for males $\pm$ SD	Total Injections for males $\pm$ SD	Total Injections for females $\pm$ SD	Mean injections per year for females $\pm$ SD	Total Injections for males $\pm$ SD	Total Injections for females $\pm$ SD	Mean Injections per year $\pm$ SD	Total Injections $\pm$ SD	Mean Injections per year $\pm$ SD	Total Injections $\pm$ SD	Mean Injections per year $\pm$ SD	Total Injections for males $\pm$ SD	Total Injections for females $\pm$ SD	Mean Injections per year $\pm$ SD	Total Injections $\pm$ SD	Mean Injections per year $\pm$ SD	Total Injections for males $\pm$ SD	Total Injections for females $\pm$ SD					
0-15	36,315,813	33,470,795	3.32 $\pm$ 3.11	120,418,624 $\pm$ 112,898,311	113,640,491 $\pm$ 104,292,395	3.40 $\pm$ 3.12	392,897,743 $\pm$ 36,511,807	32,875,721 $\pm$ 27,153,782	3.35 $\pm$ 3.11	234,069,355 $\pm$ 217,202,767	3.82 $\pm$ 9.26	137,207,322 $\pm$ 335,892,493	129,484,184 $\pm$ 310,288,367	3.82 $\pm$ 9.26	137,207,322 $\pm$ 335,892,493	129,484,184 $\pm$ 310,288,367	3.82 $\pm$ 9.26	137,207,322 $\pm$ 335,892,493	129,484,184 $\pm$ 310,288,367	3.82 $\pm$ 9.26	137,207,322 $\pm$ 335,892,493	129,484,184 $\pm$ 310,288,367			
15-19	10,238,434	9,436,345	3.98 $\pm$ 3.57	40,784,865 $\pm$ 36,511,807	39,289,743 $\pm$ 33,537,515	4.16 $\pm$ 3.55	32,600,050 $\pm$ 28,414,241	4.33 $\pm$ 3.68	4.07 $\pm$ 3.56	80,076,222 $\pm$ 70,065,979	3.78 $\pm$ 9.29	37,894,340 $\pm$ 95,237,005	36,505,181 $\pm$ 87,478,893	3.78 $\pm$ 9.29	37,894,340 $\pm$ 95,237,005	36,505,181 $\pm$ 87,478,893	3.78 $\pm$ 9.29	37,894,340 $\pm$ 95,237,005	36,505,181 $\pm$ 87,478,893	3.78 $\pm$ 9.29	37,894,340 $\pm$ 95,237,005	36,505,181 $\pm$ 87,478,893			
20-24	7,875,718	7,258,727	4.14 $\pm$ 3.61	28,439,143 $\pm$ 23,900,468	28,823,422 $\pm$ 22,550,159	4.53 $\pm$ 3.74	21,968,261 $\pm$ 18,224,037	4.74 $\pm$ 3.85	4.74 $\pm$ 3.85	57,407,050 $\pm$ 46,556,464	4.70 $\pm$ 10.52	28,179,443 $\pm$ 65,497,401	28,560,212 $\pm$ 61,796,982	4.70 $\pm$ 10.52	28,179,443 $\pm$ 65,497,401	28,560,212 $\pm$ 61,796,982	4.70 $\pm$ 10.52	28,179,443 $\pm$ 65,497,401	28,560,212 $\pm$ 61,796,982	4.70 $\pm$ 10.52	28,179,443 $\pm$ 65,497,401	28,560,212 $\pm$ 61,796,982			
25-29	6,300,575	5,806,981	4.51 $\pm$ 3.79	21,968,261 $\pm$ 18,224,037	22,586,588 $\pm$ 16,988,227	5.19 $\pm$ 3.90	18,224,037 $\pm$ 17,185,299	4.89 $\pm$ 3.92	4.89 $\pm$ 3.92	44,711,100 $\pm$ 35,304,102	4.42 $\pm$ 10.50	19,743,806 $\pm$ 49,349,863	20,299,523 $\pm$ 46,003,348	4.42 $\pm$ 10.50	19,743,806 $\pm$ 49,349,863	20,299,523 $\pm$ 46,003,348	4.42 $\pm$ 10.50	19,743,806 $\pm$ 49,349,863	20,299,523 $\pm$ 46,003,348	4.42 $\pm$ 10.50	19,743,806 $\pm$ 49,349,863	20,299,523 $\pm$ 46,003,348			
30-34	4,725,431	4,355,236	4.65 $\pm$ 3.86	20,647,842 $\pm$ 17,185,299	21,199,888 $\pm$ 16,334,823	5.15 $\pm$ 3.97	18,543,205 $\pm$ 14,739,181	5.16 $\pm$ 4.05	5.16 $\pm$ 4.05	41,946,500 $\pm$ 33,616,798	5.03 $\pm$ 12.45	21,237,829 $\pm$ 54,707,489	21,805,649 $\pm$ 52,000,092	5.03 $\pm$ 12.45	21,237,829 $\pm$ 54,707,489	21,805,649 $\pm$ 52,000,092	5.03 $\pm$ 12.45	21,237,829 $\pm$ 54,707,489	21,805,649 $\pm$ 52,000,092	5.03 $\pm$ 12.45	21,237,829 $\pm$ 54,707,489	21,805,649 $\pm$ 52,000,092			
35-39	4,462,907	4,113,278	4.63 $\pm$ 3.85	18,543,205 $\pm$ 14,739,181	19,630,937 $\pm$ 15,065,614	5.53 $\pm$ 4.25	15,788,807 $\pm$ 12,809,632	5.07 $\pm$ 3.99	5.07 $\pm$ 3.99	38,158,723 $\pm$ 29,946,563	6.39 $\pm$ 14.92	22,915,793 $\pm$ 54,466,662	24,260,019 $\pm$ 55,672,950	6.39 $\pm$ 14.92	22,915,793 $\pm$ 54,466,662	24,260,019 $\pm$ 55,672,950	6.39 $\pm$ 14.92	22,915,793 $\pm$ 54,466,662	24,260,019 $\pm$ 55,672,950	6.39 $\pm$ 14.92	22,915,793 $\pm$ 54,466,662	24,260,019 $\pm$ 55,672,950			
40-44	3,850,351	3,548,711	4.82 $\pm$ 3.83	15,788,807 $\pm$ 12,809,632	16,614,670 $\pm$ 12,560,389	5.42 $\pm$ 4.10	58,600,657 $\pm$ 46,434,133	5.72 $\pm$ 4.46	5.72 $\pm$ 4.46	32,414,190 $\pm$ 25,470,633	5.74 $\pm$ 13.38	17,809,383 $\pm$ 43,127,739	18,740,936 $\pm$ 42,288,580	5.74 $\pm$ 13.38	17,809,383 $\pm$ 43,127,739	18,740,936 $\pm$ 42,288,580	5.74 $\pm$ 13.38	17,809,383 $\pm$ 43,127,739	18,740,936 $\pm$ 42,288,580	5.74 $\pm$ 13.38	17,809,383 $\pm$ 43,127,739	18,740,936 $\pm$ 42,288,580			
45-49	3,325,303	3,064,796	4.75 $\pm$ 3.85	58,600,657 $\pm$ 46,434,133	57,152,352 $\pm$ 43,533,022	5.91 $\pm$ 4.50	46,434,133 $\pm$ 35,791,453	4.30 $\pm$ 3.75	4.30 $\pm$ 3.75	115,471,221 $\pm$ 89,954,916	5.05 $\pm$ 11.85	51,580,003 $\pm$ 123,331,906	50,305,212 $\pm$ 115,626,377	5.05 $\pm$ 11.85	51,580,003 $\pm$ 123,331,906	50,305,212 $\pm$ 115,626,377	5.05 $\pm$ 11.85	51,580,003 $\pm$ 123,331,906	50,305,212 $\pm$ 115,626,377	5.05 $\pm$ 11.85	51,580,003 $\pm$ 123,331,906	50,305,212 $\pm$ 115,626,377			
50+	10,500,958	9,678,302	5.58 $\pm$ 4.42	357,791,453 $\pm$ 311,117,109	351,813,812 $\pm$ 292,015,925	4.44 $\pm$ 3.80	311,117,109 $\pm$ 292,015,925	4.30 $\pm$ 3.75	4.30 $\pm$ 3.75	709,728,658 $\pm$ 603,767,153	5.12 $\pm$ 11.95	368,522,846 $\pm$ 893,526,411	362,186,061 $\pm$ 839,881,247	5.12 $\pm$ 11.95	368,522,846 $\pm$ 893,526,411	362,186,061 $\pm$ 839,881,247	5.12 $\pm$ 11.95	368,522,846 $\pm$ 893,526,411	362,186,061 $\pm$ 839,881,247	5.12 $\pm$ 11.95	368,522,846 $\pm$ 893,526,411	362,186,061 $\pm$ 839,881,247			
Total	87,595,490	80,733,171	4.17 $\pm$ 3.70	311,117,109	292,015,925	4.44 $\pm$ 3.80	311,117,109	4.30 $\pm$ 3.75	4.30 $\pm$ 3.75	709,728,658	5.12 $\pm$ 11.95	368,522,846	362,186,061	5.12 $\pm$ 11.95	368,522,846	362,186,061	5.12 $\pm$ 11.95	368,522,846	362,186,061	5.12 $\pm$ 11.95	368,522,846	362,186,061			

**Table-2: Annual Supply and Availability of Syringes (in Millions).**

<b>Total Availability</b>	<b>1194 - 1254</b>
Local production/ year	744-804* + 10 auto-disable
Imports (CBR Data)/ year	450
<b>Total Usage Other Than For Therapeutic Injections</b>	<b>333 - 348</b>
Estimated Vaccine and Insulin syringes (From imports)	40
Injections used in Laboratories (25%)	291 - 306
Injections supplied to Injection Drug Users by HIV prevention programs	2
<b>Syringe Supply To Market For Therapeutic Injections</b>	<b>861 - 961</b>
<b>Syringe Need</b>	<b>709-731</b>
Pakistan Medical Research Council Survey (N ± SD)	709 ± 604
Pakistan Demographic Health Survey (N ± SD)	731 ± 867
<b>Excess Availability of Syringes for Therapeutic injections</b>	<b>152 - 175</b>

\* Syringe Manufacturers' data.

## Discussion

This was the first study to compare the overall national need for syringes for therapeutic injections against the supply of syringes. Using 2 large studies that recruited subjects from nationwide probability samples, we estimated that around 709-731 (4.3-51) million therapeutic injections are received in Pakistan, excluding injections for insulin, vaccines and syringes supplied to injection drug users via government programmes. This figure is lower than what has been previously cited and is at least matched by the supply of syringes. Thus syringe shortage is unlikely to explain syringe reuse as has been previously claimed.

At 4.3-4.6 injections per head annually, the overall injection frequency in Pakistan is among the highest worldwide.<sup>14,15</sup> International data suggest that in countries with comparable health systems and quality standards, around 2 therapeutic injections per person are received annually (sub-Saharan Africa: 0.9-3,<sup>15</sup> parts of Asia: 1.2 to 2.1<sup>15</sup> and Latin America: 1.2 - 2.7<sup>7</sup>) and is consistent with data from Pakistan where prescriptions by formal providers include an average of 1.5 injections<sup>9</sup> and up to 94% of all injections considered unnecessary.<sup>8</sup> However, injection overuse without syringe reuse will not increase transmission of blood-borne infections. Literature suggests that syringes are reused in 17% to 50%<sup>1,3,10,16</sup> of all injections in Pakistan and up to 94% in some other countries.<sup>17</sup>

We found that the national availability of syringes slightly exceeds the need. Syringe reuse of 17-50% would mean that about 120-400 million syringes would be surplus in the market during any given year. Such an over-supply would have lowered the price of syringes and/or caused local or generalised gluts of syringes across the country. Prices of syringes have not fallen and the syringe manufacturers' association reports no gluts or supply inconsistencies. Thus, while higher reuse is reported from some localities,<sup>18</sup> the average reuse is much lower nationwide. This is consistent with the observation that national prevalence of Hepatitis B and C have remained stable for the past decade,<sup>13</sup> suggesting

limited iatrogenic transmission of these infections. However, even this limited transmission has been sufficient to yield an overall national prevalence of 2.5% for Hepatitis B and 5% for Hepatitis C, which for Pakistan means that over 12 million individuals are infected with either Hepatitis B or C virus.<sup>1</sup>

The matched supply and need for syringes suggest that supply shortages are unlikely to explain reuse. This is further supported by the fact that average injections in Pakistan costs around Rs. 40 (USD 0.5)<sup>19</sup> or more, and the cost of an ordinary single-use syringe (Rs. 2-7 or USD 0.03-0.09) is a small fraction of this cost. Since patients are seldom aware of this breakdown, it is highly unlikely they determine reuse. It is likely that majority of reuse is by a few providers only.

Efforts to reduce injections or syringe reuse in the medical sector must involve both providers and their patients. Provider interventions would include re-training providers in the correct indications for injections and re-emphasising the risks of injections such as infections and injection injury,<sup>20</sup> establishing quality standards for medical care that promote these principles and ensuring that these standards are followed. This will require addressing medical or other pre-service training of medical care providers and be reinforced periodically with in-service refreshers. Enforcing any of this will be difficult as most of the healthcare in Pakistan<sup>21</sup> and nearly all injections (including most that are prescribed in the public sector) are given in the private sector, many in conditions of uncertain sterility and with reused equipment.<sup>22</sup>

Given this scenario, the most efficient approaches would likely be those that target patients and may include mass media campaigns and community/interpersonal outreach such as the Health Ministry's large-scale Lady Health Workers Programme. These efforts would inform the public about the lack of necessity of therapeutic injections in most clinical scenarios, emphasise the risks involved with such injections and encourage patients to insist on new syringes for the injections they receive, hence making them better consumers of healthcare.



The use of single-use equipment, such as auto-disable syringes, has been discussed nationally. These constitute roughly 1-2% of the current syringe supply and are slightly more expensive (Rs. 7-9 or USD 0.09-0.11) than regular syringes. However, since reuse seems driven largely by a few providers who may be financially motivated to reuse single-use equipment, the role of auto-disable syringes is uncertain unless they are either the only kind of syringes available or have their use enforced by law; both seem distant possibilities at present.

The study had several limitations. We used third party data which were not primarily intended for a syringe need analysis. Besides, we made a number of assumptions that may have introduced errors in either direction. For example, in the PDHS data, we assumed that men received the same number of injections as age-matched women. This could be higher for men due to higher access to healthcare. In fact, the PMRC data suggests that men receive about 5-10% more injections, which, while significant, represents a small difference in the total number of syringes. Similarly, in the PDHS we extrapolated data for <15 and >49 age groups. It is likely that the younger group actually receives fewer and the older group receives more injections. However, since proportion of population <15 years is huge and those >49 are few, our estimates may have exaggerated the actual number of injections nationwide. Finally the data provided by the syringe manufacturers, is an estimate. Actual production and supply to laboratories varies on a monthly and yearly basis, although within a  $\pm 10\%$  range.

### Conclusion

The study demonstrated that the huge need for therapeutic injections in Pakistan is completely met by the supply of fresh syringes, suggesting that syringe reuse is likely lower than previously considered and may be driven by provider factors. A number of measures aimed at providers and patients are needed to curtail injection overuse and syringe reuse. These measures must be informed by better understanding of patients' desire for injections, trials of interventions that reduce injection demand and enhance new syringe use and modalities to effectively train medical care providers (including non-doctors) to use injections judiciously. These efforts will require a combination of research and effective government programmes to train providers and enforce regulations.

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